

APPENDIX C

QA-Related Records

APPENDIX C-1

QA Level Assignment Sheet

WMPO QUALITY ASSURANCE LEVEL ASSIGNMENT SHEET

N-QA-057
4/88

Items/Activities	QA Level	QA Criteria	Technical Justification
Technical Assessment Review, Part I: ESF	I	1,2,3,5,6,10,16,	This technical Assessment review is being conducted, in part, to address NRC concerns about the potential impacts of ESF design on the ability of the
Title I Design Acceptability Analysis		17, 18	prospective repository to isolate waste and on the ability of ESF-related site-characterization activities to collect site data needed to assess repository performance; activity meets criteria for QA Level I according to
			step 2 of the attached QA Level Assignment Checklist. (Note: To date no determination has been made whether any part of the ESF design is important to waste isolation.) Criteria excluded; 4,7,12 - no equipment or purchased
			services required; 8 - no materials, parts or components involved; 9 - not a special process; 11 - no tests or experiments involved; 12 - no measuring or test equipment involved; 13 - no handling, storage or shipping of equipment
			or geologic materials; 14 - no structures, systems or components to be controlled; 15 - no use or installation or materials, parts, or components.
TAR Part II: Assessment of Alternative Locations for the ESF	I	Same as above	Justification for assignment of QA Level I -- same as above. Criteria excluded -- same as above.
TAR Part II, Subtask: Calculation of ground-water travel times	III	N/A	Ground water travel times at alternative ESF locations considered will be calculated to support the technical assessment of significant differences in waste-isolation potential of different locations. As the results of these
			calculations can be qualitatively anticipated, they are not critical to the review but will enhance the credibility of the review.

APPROVALS (Signature and Date)

Task Manager

Henry Z. King 1/5/89

WMPO PQM

James B. Blythe 1/6/89

Department Manager

Michael D. Begele 1-5-89

WMPO Branch Chief

Maxwell B. Blumherl 1-5-89

C.1-1

QA LEVEL ASSIGNMENT CHECKLIST (SOP-02-02 REFERENCE PARAGRAPH)

<u>STEP</u>	<u>CHARACTERISTIC</u>	<u>LEVEL</u>
1	DOES THE ITEM OR ACTIVITY INVOLVE OR AFFECT PUBLIC RADIOLOGIC HEALTH AND SAFETY?	
	YES _____	I
2	DOES THE ITEM OR ACTIVITY INVOLVE WASTE ISOLATION?	
	YES _____	I
3	DOES THE ITEM OR ACTIVITY INVOLVE OR AFFECT RETRIEVABILITY?	
	YES _____	I
4	IS THE INTENDED PURPOSE OF THIS ACTIVITY TO PROVIDE DATA FOR A LICENSE APPLICATION?	
	YES _____	I
5	CAN THE FAILURE OF THE ITEM OR ACTIVITY CAUSE A FAILURE OF A QA LEVEL I ITEM, OR IRRETRIEVABLE LOSS OF QA LEVEL I DATA?	
	YES _____	I
6	DOES THE ACTIVITY INVOLVE A DESIGN PHASE WHICH IS TO BE CONDUCTED IMMEDIATLY PRIOR TO APPLICATION FOR A NRC LICENSE, PROCUREMENT OR CONSTRUCTION?	
	YES _____	I
7	CAN THE ITEM OR ACTIVITY HAVE A MAJOR IMPACT ON NON-RADIOLOGICAL OR OCCUPATIONAL HEALTH AND SAFETY?	
	YES _____	II
8	IF THE ITEM OR ACTIVITY WERE TO FAIL OR IS PERFORMED INADEQUATELY COULD REPOSITORY WORKERS BE EXPOSED TO RADIATION OR RADIOACTIVE CONTAMINATION LEVELS IN EXCESS OF THE LIMITS EXPRESSED IN 10 CFR 20?	
	YES _____	II
9	DOES THE ITEM OR ACTIVITY HAVE A MAJOR IMPACT ON THE NON-RADIOLOGICAL OPERATION, RELIABILITY OR MAINTAINABILITY OF ENGINEERED SYSTEMS, STRUCTURES OR COMPONENTS?	
	YES _____	II
10	DOES THE ITEM OR ACTIVITY INVOLVE A DESIGN PHASE FOR WHICH THE PRINCIPLE PURPOSE IS TO CONDUCT A COMPARATIVE TECHNICAL ANALYSIS OF ALTERNATIVES?	
	YES _____	II
11	CAN THE ITEM OR ACTIVITY CAUSE MAJOR COST OVERRUN OR SCHEDULE SLIPPAGE?	
	YES _____	II
LEVEL III WHEN ALL THE ANSWERS TO ALL THE QUESTIONS ABOVE IS "NO".		

APPENDIX C-2

TAR Assessment Review Team Selection Record (N-QA-008)

TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD

N-QA-008
7/88

Technical Assessment Review Subject ESF 100% Title I Design Acceptability
Analysis & ESF-Location Comparative Evaluation

FUNCTION	REPRESENTATIVE
Secretary & Geophysicist	Richard Lee
Hydrologist/Hydrogeologist	Craig B. Bentley
Hydrologist/Hydrogeologist	William E. Wilson
Geologist	Scott Van Camp
Performance Assessment Specialist & Hydrogeologist	Cliff Novonha
Performance Assessment Specialist & Geotechnical Engineer	Joe Tillerson
Performance Assessment Specialist & Regulatory Specialist	Felton Bingham
Performance Assessment Specialist & Regulatory Specialist	Scott Sinnock
Mining Engineer, Geotechnical Engineer, & Performance Assessment Specialist	Charles Voss
Regulatory Specialist	Miguel Lugo
Geophysicist & Regulatory Specialist	Jeffrey K. Kimball
Hydrologist/Hydrogeologist & Performance Assessment Specialist	Ralph C. Cady
Mining Engineer	Dermot Ross-Brown
Geophysicist	Ernest L. Hardin
Geologist	August C. Mathhisen
Hydrologist/Hydrogeologist	Keith M. Kensch
Geotechnical Engineer & Performance Assessment Specialist	Michael D. Voegelé

Based on review of the qualification documentation, these representatives cover the functions for this Review and are acceptable as team members to accomplish the scope and purpose of this review.

Attachment:

Qualification Documentation

Signed

Henry 2 King
December 16, 1988

C. 2-2

APPENDIX C-3

**Employer Certification of Committee Team Member
Qualifications and Independence**



Science Applications International Corporation
An Employee-Owned Company

WBS#: 1.2.3.3.6.2
QA: "N/A"

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, SAIC-Golden (technical support contractor to the U.S. Geological Survey) certifies that Sandra Doty meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Mining Engineer/Geotechnical Engineer in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

SAIC-Golden also certifies that Sandra Doty was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

SAIC-Golden acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Timothy H. Barbour, Manager

Name and Title *for R.L. Wise*

December 21, 1988

Date

RLW:cp

TARESF.RLW

cc: Dan Gillies, USGS
Tim Barbour, SAIC-Golden
File: 527-32-1-1

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy

Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

WBS # 1.2.9
"QA: N/A"

DEC 15 1988

NN1.681215.0001

Dr. Jerry L. King
Science Applications International Corporation
The Valley Bank Center, Suite 407
101 Convention Center Drive
Las Vegas, NV 89109

CATEGORIES OF TECHNICAL ASSESSMENT REVIEW (TAR) TEAM MEMBER

By this letter, the Regulatory & Site Evaluation Division of the Yucca Mountain Project Office, U.S. Department of Energy (DOE), Nevada Operations Office, certifies that W. Arch Girdley, Supervisory Physical Scientist and Chief, Technical Analysis Branch, meets the minimum education and experience criteria, as described in the enclosure, for participation as a Geologist in the TAR of the Exploratory Shaft Facility (ESF) Title I design being conducted by the Yucca Mountain Project Office.

The DOE also certifies that W. Arch Girdley was not a principal contributor to ESF Title I design of the Subsystem Design Requirements Document which was used for ESF Title I design.

Maxwell B. Blanchard

Maxwell B. Blanchard, Director
Regulatory & Site Evaluation Division
Yucca Mountain Project Office

YMP:RAL-1053

Enclosure:
Categories of TAR Team Member

Dated: 12-14-88

cc w/o encl:
E. L. Wilmot, YMP, NV

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy
Washington, DC 20585

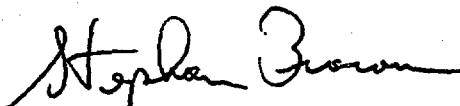
Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U.S. Department of Energy certifies that Jeffrey K. Kimball meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Geophysicist, Regulatory Specialist or Performance Assessment Evaluation Specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

U.S. Department of Energy also certifies that Jeffrey K. Kimball was not a principal contributor to ESF Title I Design or the Subsystem Design Requirements Document which was used for ESF Title I Design.

U.S. Department of Energy acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.


Stephan J. Brocoun, Chief
Siting and Geosciences Branch
Office of Civilian Radioactive
Waste Management

DATE: Dec 16, 1988

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

M88-TED/JLK-101
WBS #1.2.6.1.1
QA LEVEL I

INTER-OFFICE MEMO

DATE: December 19, 1988
TO: Review Record Memorandum
Technical Assessment Review, ESF 100% Title I Design
FROM: William V. Macnabb *WV*
SUBJECT: Qualifications of SAIC members of Technical Assessment Review Team.

Science Applications International Corporation (SAIC) certifies that the SAIC personnel listed below meet the minimum education and experience criteria for the indicated technical disciplines, as described in Attachment 1, for participation in the Technical Assessment Review of ESF Title I design, being conducted by the Yucca Mountain Project Office.

SAIC also certifies that none of the listed personnel were principal contributors to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

<u>Team Member</u>	<u>Technical Discipline</u>
Jerry L. King	Geophysicist
Richard C. Lee	Geophysicist
Keith M. Kersch	Hydrogeologist
August C. Matthusen	Geologist
Ernest L. Hardin	Geophysicist

Review Record Memorandum
M88-TED/JLK-101
December 19, 1988
Page Two

Michael D. Voegele

Geotechnical Engineer & Performance
Assessment/Evaluation Specialist

Dermot M. Ross-Brown

Mining Engineer

J. V. Macneil, Deputy Project Mgr
Name & Title

Dec. 19, 1988
Date

WVM:JLK:rlv

cc:
M. E. Spaeth

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 421
DENVER FEDERAL CENTER
DENVER, COLORADO 80225



IN REPLY REFER TO:

December 12, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U. S. Geological Survey certifies that Craig B. Bentley meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

The U. S. Geological Survey also certifies that Craig B. Bentley was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

U. S. Geological Survey acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Larry Hume, Chief Branch 4 YMP
Name and Title

12/12/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

Category

Minimum Criteria for Qualification

Mining Engineer

Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.

Performance Assessment/
Evaluation Specialist

Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.

Geotechnical Engineer

Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.

Geologist,
Geochemist,
Geophysicist, or
Hydrologist/
Hydrogeologist

Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.

Regulatory Specialist

Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

Sandia National Laboratories

Albuquerque, New Mexico 87185

December 13, 1988

WBS: 1.2.9.3

QA

Dr. Jerry L. King, Chairman
Technical Assessment Review Team
ESF 100%-Title-I Design
Science Applications International Corp.
101 Convention Center Dr.
Suite 407
Las Vegas, Nevada 89109

Dear Dr. King:

By this letter, Sandia National Laboratories certifies that Felton Bingham meets the minimum education and experience criteria, as described in Attachment 1, for participation as a performance assessment/evaluation specialist and regulatory specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Sandia National Laboratories also certifies that Felton Bingham was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Sandia National Laboratories acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.



Joseph E. Stiegler
Acting Department Manager

12/13/88
Date

6312:mjh
Attachment

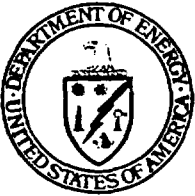
Copy to: (w/attach.)
6310 J. E. Stiegler, Actg.
6312 F. W. Bingham
6310 90/1293/CRT/Q1
6310 NNWSICF

C.3-12

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
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Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy
Washington, DC 20585

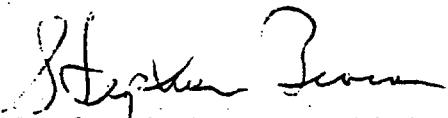
Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U.S. Department of Energy certifies that Ralph C. Cady meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist or or Performance Assessment Evaluation Specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

U.S. Department of Energy also certifies that Ralph C. Cady was not a principal contributor to ESF Title I Design or the Subsystem Design Requirements Document which was used for ESF Title I Design.

U.S. Department of Energy acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.


Stephan J. Brocoun, Chief
Siting and Geosciences Branch
Office of Civilian Radioactive
Waste Management

DATE: Dec 16, 1988

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



M88-TED/JLK-104
WBS #1.2.6.1.1
QA LEVEL I

INTER-OFFICE MEMO

DATE: December 29, 1988

TO: Jerry L. King

FROM: William V. Macnabb *WV Macnabb*

SUBJECT: Qualifications of SAIC members of Technical Assessment Review Team

Science Applications International Corporation (SAIC) certifies that the SAIC personnel listed below meet the minimum education and experience criteria for the indicated technical disciplines, as described in Attachment 1, for participation in the Technical Assessment Review of ESF Title I design, being conducted by the Yucca Mountain Project Office.

SAIC also certifies that none of the listed personnel were principal contributors to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Team Member

Paul Cloke

Technical Discipline

Geochemist

W V Macnabb, Deputy Project Mgr
Name & Title

Dec 29, 1988
Date

WVM:JLK:rlv

cc:
M. E. Spaeth

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

Sandia National Laboratories

Albuquerque, New Mexico 87185

January 10, 1989

WBS: 1.2.4.6.2

QA

Dr. Jerry L. King, Chairman
Technical Assessment Review Team,
ESF 100%-Title-I Design
Science Applications International
Corporation
The Valley Bank Center
101 Convention Center Drive, Suite 407
Las Vegas, NV 89109

Dear Dr. King:

Subject: Technical Assessment Review - ESF Title I Design

By this letter, Sandia National Laboratories (SNL) certifies that Laurence S. Costin meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Geotechnical Engineer in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

SNL also certifies that Laurence S. Costin was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

SNL acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Sincerely,



J. E. Stiegler, Manager, Actg.
Nuclear Waste Repository Technology
Department 6310

ALStevens:6311:sj

Copy to:
6310 J. E. Stiegler, Actg.
6310 60/12462/DIM-231/1.1/Q1
6310 YMPCF
6314 J. R. Tillerson
6314 L. S. Costin
6314 R. J. Flores

C.3-18

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

J. King

December 16, 1988

TWS-N5-12-88-047

Mr. M. Voegel
Science Applications
International Corporation
The Valley Bank Center
101 Convention Center Drive, Suite 407
Las Vegas, NV 89109

Dear Mr. Voegel:

SUBJECT: LANL SUPPORT OF ESF TITLE I DESIGN DEFENSE

Confirming our conversations of the past several days, Bruce M. Crowe of our Las Vegas office has agreed to assist you in the Technical Assessment Review of the ESF Title I design. Bruce will provide the geochemical perspective you requested. Please engage Bruce as you require. He is located in Suite P230 of the Valley Bank complex and can be reached by telephone locally at 4-7096.

We are pleased to be able to support your efforts through Bruce.

Sincerely,


R. J. Herbst

RJH/rv

xc: B. M. Crowe, N-5, MS J900/527
J. A. Canepa, N-5, MS J521
D. T. Oakley, N-5, MS J521
R. J. Herbst, N-5, MS J521
H. N. Kalia, ESS-1, MS J900/527
RPC file (2)
TWS-N5 file
CRM-4 (2), MS A150

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

January 10, 1989

TWS-N5-01-89-023

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

SUBJECT: ESF TITLE I TECHNICAL ASSESSMENT REVIEWER

By this letter, Los Alamos National Laboratory certifies that Bruce M. Crowe meets the minimum education and experience criteria, as described in Attachment 1, for participation as a geochemist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Los Alamos National Laboratory also certifies that Bruce M. Crowe was not a principal contributor to ESF Title design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Los Alamos National Laboratory acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or The U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.



Donald T. Oakley
Technical Project Officer

10 January 1989

DATE

RJH/jw

Cy. w/attachment
R. J. Herbst, N-5, MS J521
TWS-N5, MS M321
TWS-N5, MS J521
RPC File

Cy. w/o attachment
B. M. Crowe, N-5, MS J900/527

C.3-21

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Science Applications International Corporation
An Employee-Owned Company

WBS#: 1.2.3.3.6.2
QA: "N/A"

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, SAIC-Golden (technical support contractor to the U.S. Geological Survey) certifies that Sandra Doty meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Mining Engineer/Geotechnical Engineer in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

SAIC-Golden also certifies that Sandra Doty was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

SAIC-Golden acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Timothy G. Barbour, Manager

Name and Title *for R.L. Wise*

December 21, 1988

Date

RLW:cp

TARESF.RLW

cc: Dan Gillies, USGS
Tim Barbour, SAIC-Golden
File: 527-32-1-1

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy

Nevada Operations Office

P. O. Box 98518

Las Vegas, NV 89193-8518

DEC 15 1988

WBS # 1.2.9

"QA: N/A"

NN1.001215.0001

Dr. Jerry L. King
Science Applications International Corporation
The Valley Bank Center, Suite 407
101 Convention Center Drive
Las Vegas, NV 89109

CATEGORIES OF TECHNICAL ASSESSMENT REVIEW (TAR) TEAM MEMBER

By this letter, the Regulatory & Site Evaluation Division of the Yucca Mountain Project Office, U.S. Department of Energy (DOE), Nevada Operations Office, certifies that W. Arch Girdley, Supervisory Physical Scientist and Chief, Technical Analysis Branch, meets the minimum education and experience criteria, as described in the enclosure, for participation as a Geologist in the TAR of the Exploratory Shaft Facility (ESF) Title I design being conducted by the Yucca Mountain Project Office.

The DOE also certifies that W. Arch Girdley was not a principal contributor to ESF Title I design of the Subsystem Design Requirements Document which was used for ESF Title I design.

Maxwell B. Blanchard

Maxwell B. Blanchard, Director
Regulatory & Site Evaluation Division
Yucca Mountain Project Office

YMP:RAL-1053

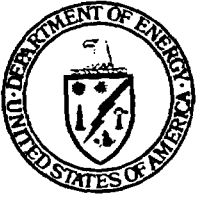
Enclosure:
Categories of TAR Team Member

Dated: 12-14-88

cc w/o encl:
E. L. Wilmot, YMP, NV

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy
Washington, DC 20585

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U.S. Department of Energy certifies that Jeffrey K. Kimball meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Geophysicist, Regulatory Specialist or Performance Assessment Evaluation Specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

U.S. Department of Energy also certifies that Jeffrey K. Kimball was not a principal contributor to ESF Title I Design or the Subsystem Design Requirements Document which was used for ESF Title I Design.

U.S. Department of Energy acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

A handwritten signature in cursive script, reading "Stephan J. Brocoun", is positioned above the typed name.

Stephan J. Brocoun, Chief
Siting and Geosciences Branch
Office of Civilian Radioactive
Waste Management

DATE: Dec 16, 1988

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 421
DENVER FEDERAL CENTER
DENVER, COLORADO 80225



IN REPLY REFER TO:

December 16, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U. S. Geological Survey certifies that Ed Kwicklis meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

The U. S. Geological Survey also certifies that Ed Kwicklis was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

U. S. Geological Survey acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Larry R. Horn Chief, Branch Ymb
Name and Title

12/16/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Department of Energy

Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

WBS # 1.2.9
"QA: N/A"

NN1.881215.0003

DEC 15 1988

Dr. Jerry L. King
Science Applications International Corporation
The Valley Bank Center, Suite 407
101 Convention Center Drive
Las Vegas, NV 89109

CATEGORIES OF TECHNICAL ASSESSMENT REVIEW (TAR) TEAM MEMBER

By this letter, the Regulatory & Site Evaluation Division of the Yucca Mountain Project Office, U.S. Department of Energy (DOE), Nevada Operations Office, certifies that Robert A. Levich, Supervisory Physical Scientist and Chief, Technical Analysis Branch, meets the minimum education and experience criteria, as described in the enclosure, for participation as a Geologist in the TAR of the Exploratory Shaft Facility (ESF) Title I design being conducted by the Yucca Mountain Project Office.

The DOE also certifies that Robert A. Levich was not a principal contributor to ESF Title I design of the Subsystem Design Requirements Document which was used for ESF Title I design.

YMP:RAL-1052

Enclosure:
Categories of TAR Team Member

Maxwell Blanchard
Maxwell B. Blanchard, Director
Regulatory & Site Evaluation Division
Yucca Mountain Project Office

Dated: 12-14-88

cc w/o encl:
E. L. Wilmot, YMP, NV

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



955 L'ENFANT PLAZA, S.W.
8TH FLOOR
WASHINGTON, D.C. 20024
PHONE: (202) 646-6600

December 13, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, Roy F. Weston certifies that Miguel Lugo meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Regulatory Specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Roy F. Weston also certifies that Miguel Lugo was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Roy F. Weston acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

W. F. Weston Manager
Name and Title Regulatory Compliance Dept
12/13/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



Science Applications International Corporation
An Employee-Owned Company

WBS#: 1.2.3.3.6.2
QA: "N/A"

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, SAIC-Golden (technical support contractor to the U.S. Geological Survey) certifies that Joshua Marvil meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

SAIC-Golden also certifies that Joshua Marvil was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

SAIC-Golden acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Timothy L. Barbour, Manager

Name and Title *for R.L. Wise*

December 21, 1988

Date

RLW:cp

TARESF.RLW

cc: Dan Gillies, USGS
Tim Barbour, SAIC-Golden
File: 527-32-1-1

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

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Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
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955 L'ENFANT PLAZA, S.W.
8TH FLOOR
WASHINGTON, D.C. 20024
PHONE: (202) 646-6600

December 13, 1988


Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, Roy F. Weston certifies that Cliff Noronha meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Performance Assessment/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Roy F. Weston also certifies that Cliff Noronha was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Roy F. Weston acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.


Name and Title Manager, Regulatory
12/13/88 Compliance Dept
Date

Categories of TAR team member technical disciplines, and criteria for qualification in each category

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Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
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Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



IN REPLY
REFER TO:
D-3790

United States Department of the Interior

BUREAU OF RECLAMATION

DENVER OFFICE

P O BOX 25007
BUILDING 67, DENVER FEDERAL CENTER
DENVER, COLORADO 80225-0007



WBS #: 1.2.3.1
QA: QA

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas NV 89109

Dear Dr. King:

Enclosed is a copy of a letter certifying that Joseph V. Prizio meets the minimum education and experience criteria for participation in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Sincerely,

David W. Harris, Ph.D., P.E.
Technical Program Officer, YMPG

Enclosure:

cc: U.S. Geological Survey, Attention: MS-421 (L. Hayes), PO Box 25046,
Denver CO 80225

UNITED STATES GOVERNMENT
memorandum

TO : Memorandum
Robert Peterson, Quality Assurance Manager,
Yucca Mountain Project Group

Denver, Colorado
DATE: December 20, 1988

FROM : Thomas Luebke, Design Manager

SUBJECT: Certification of Joseph V. Prizio for Work on the Exploratory Shaft Facility
Title I Design Review

By this letter, Bureau of Reclamation certifies that Joseph V. Prizio meets the minimum education and experience criteria, as described in Attachment 1, for participation as an engineer in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

The Bureau of Reclamation also certifies that Joseph V. Prizio was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

The Bureau of Reclamation acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

T. A. Luebke SUPV. CIVIL ENGINEER
Name and Title

12-21-88
Date

cc: D-3620
D-3620N (Prizio/Lippert)
D-3790 (Harris)

Joseph V. Prizio
Civil Engineer, P.E.

3475 Heidelberg Drive
Boulder CO 80303

Education

Bachelor of Science, Geology, Boston College 1972
MSCE, Soil Mechanics, University of Massachusetts, Amherst, 1976
Advances soil mechanics courses, University of Colorado, Boulder and Denver

Employment

1976-1977 U.S. Geological Survey, Metairie, Louisiana
Regulatory control of offshore oil, gas and mineral leases.

1977 to present Bureau of Reclamation, Denver, Colorado
Design, construction and safety evaluation of earthen dams.

Specific duties consist of:

Appraisal-level designs;
Analysis of complex geotechnical problems;
Formulation of field and laboratory data;
Development of computer applications for engineering and management;
Construction management;
Construction inspection;
Operation and maintenance inspections;
Preparation of engineering reports.

Registration

Professional Engineer, Colorado

Affiliations

U.S. Committee on Large Dams

Sandia National Laboratories

Albuquerque, New Mexico 87185

December 13, 1988

WBS: 1.2.9.3

QA

Dr. Jerry L. King, Chairman
Technical Assessment Review Team
ESF 100%-Title-I Design
Science Applications International Corp.
101 Convention Center Dr.
Suite 407
Las Vegas, Nevada 89109

Dear Dr. King:

By this letter, Sandia National Laboratories certifies that Scott Sinnock meets the minimum education and experience criteria, as described in Attachment 1, for participation as a performance assessment/evaluation specialist, geologist, and regulatory specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Sandia National Laboratories also certifies that Scott Sinnock was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Sandia National Laboratories acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.



Joseph E. Stiegler
Acting Department Manager

12/13/88
Date

6312:mjh
Attachment

Copy to: (w/attach.)
6310 J. E. Stiegler, Actg.
6317 S. Sinnock
6310 90/1293/CRT/Q1
6310 NNWSICF

C.3-42

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

Sandia National Laboratories

Albuquerque, New Mexico 87185

December 13, 1988

WBS: 1.2.9.3

QA

Dr. Jerry L. King, Chairman
Technical Assessment Review Team
ESF 100%-Title-I Design
Science Applications International Corp.
101 Convention Center Dr.
Suite 407
Las Vegas, Nevada 89109

Dear Dr. King:

By this letter, Sandia National Laboratories certifies that Joe Tillerson meets the minimum education and experience criteria, as described in Attachment 1, for participation as a performance assessment/evaluation specialist and geotechnical engineer in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Sandia National Laboratories also certifies that Joe Tillerson was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Sandia National Laboratories acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.



Joseph E. Stiegler
Acting Department Manager

12/13/88
Date

6312:mjh
Attachment

Copy to: (w/attach.)
6310 J. E. Stiegler, Actg.
6314 J. R. Tillerson
6310 90/1293/CRT/Q1
6310 NNWSICF

C.3-44

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 421
DENVER FEDERAL CENTER
DENVER, COLORADO 80225



IN REPLY REFER TO:

December 16, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U. S. Geological Survey certifies that Robert C. Trautz meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

The U. S. Geological Survey also certifies that Robert C. Trautz was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

U. S. Geological Survey acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Darrell R. Hays Chief, Branch
Name and Title

12/16/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



955 L'ENFANT PLAZA, S.W.
8TH FLOOR
WASHINGTON, D.C. 20024
PHONE: (202) 646-6600

December 13, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, Roy F. Weston certifies that Scott Van Camp meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Geologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

Roy F. Weston also certifies that Scott Van Camp was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

Roy F. Weston acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

David F. Fenster
Name and Title

12/13/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

December 13, 1988



Pacific Northwest Laboratories
P.O. Box 999
Richland, Washington U.S.A. 99352
Telephone (509)
Telex 15-2874

Dr. Jerry L. King, Chairman
Technical Assessment Review Team,
ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, Nevada 89109

Dear Dr. King:

By this letter, Pacific Northwest Laboratory (PNL) certifies that Charles F. Voss meets the minimum education and experience criteria, as described in Attachment 1, for participation as a mining engineer, geotechnical engineer and performance assessment specialist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

PNL also certifies that Charles F. Voss was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

PNL acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

A handwritten signature in dark ink, appearing to read "M. R. Kreiter", is written over a horizontal line.

M. R. Kreiter, Manager
Office of Civilian Waste Programs

13 December 1988
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.



United States Department of the Interior



GEOLOGICAL SURVEY
BOX 25046 M.S. 421
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY REFER TO:

December 12, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
101 Convention Center Drive
Las Vegas, NV 89109

Dear Dr. King:

By this letter, U. S. Geological Survey certifies that William E. Wilson meets the minimum education and experience criteria, as described in Attachment 1, for participation as a Hydrologist/Hydrogeologist in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

The U. S. Geological Survey also certifies that William E. Wilson was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

U. S. Geological Survey acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U. S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Lam Hays Chief Branch of YMP
Name and Title

12/12/88
Date

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

December 12, 1988

Dr. Jerry L. King, Chairman
Technical Assessment Review Team, ESF 100%-Title-I Design
Science Applications International Corporation
Las Vegas, NV 89109

Dear Dr. King:

By this letter, (employer's name) certifies that (team member's name) meets the minimum education and experience criteria, as described in Attachment 1, for participation as a (technical discipline or disciplines) in the Technical Assessment Review of ESF Title I design being conducted by the Yucca Mountain Project Office.

(Employer's name) also certifies that (team member's name) was not a principal contributor to ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

(Employer's name) acknowledges its responsibility to: (1) obtain and retain documentation verifying the education, experience, and independence of the review team member; (2) make this documentation available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the U. S. Department of Energy; and (3) notify the Yucca Mountain Project Office prior to destruction of this verification documentation.

Name and title

Date

SAIC Telecopy Numbers

FTS 544-7008

702-794-7008

FTS 544-7009

702-794-7009

Verify

FTS 544-7780

702-794-7780

FTS 544-7781

702-794-7781

Attachment 1

Categories of TAR team member technical disciplines, and criteria for qualification in each category

<u>Category</u>	<u>Minimum Criteria for Qualification</u>
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

APPENDIX C-4

QMP-02-08 and TAR Plan Training Documentation

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/13/88
GOAL/DATE

Craig b. Bentley has studied the following topics:
(NAME)

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1. _____	SAIC policies and procedures (<u>Familiari- zation Manual, Section 3.0</u>)	_____	_____	_____
2. _____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3. _____	<u>NNWSI Project Plan</u>	_____	_____	_____
4. _____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5. _____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6. _____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7. _____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: CRAIG B. BENTLEY [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by Design 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>[Signature]</u>	<u>12-13-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: CRAIG B BENTLEY [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>[Signature]</u>	<u>12/13/88</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Felton W. Bingham
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached _____

J. L. King 1/26/89
 APPROVING MANAGER'S SIGNATURE DATE

J. L. King, TAR Chairman
 MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Felton W. Bingham [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002, Title IYou are assigned to complete the following specialty training by 12/13/88
Design (Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JWB</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Felton W. Bingham [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>JWB</u>	<u>12/19/88</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. Attend the following special training course(s):

<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
December 19, 1988
(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8; it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Ralph Cady has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9. _____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	TAMSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached _____

J. L. King
 APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: RALPH CADY [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>R.C.</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)
12/14/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: RALPH CADY (Print Name) [REDACTED] (SSN) Date Prepared 12/15/88ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>R.C.</u>	<u>12/15/88</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. Attend the following special training course(s):

<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/15/88
(Date)

* The initial TAR Plan was issued inadvertently issued as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/28/88
GOAL/DATE

Paul Cloke
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

	1/26/89	DATE
APPROVING MANAGER'S SIGNATURE		

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Paul Cloke _____ Date Prepared 12/28/88
(Print Name) (SSN)

ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF Title I Design

You are assigned to complete the following specialty training by 12/28/88
(Date)

Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>pc</u>	<u>12/05/88</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>pc</u>	<u>12/30/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Jerry L. King _____ T.A.R. Chairperson _____
(Print Name) (Title)
Jerry L. King _____ December 29, 1988 _____
(Signature) (Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have read Rev. 0. C.4-15

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program

⁸⁹
1/6/88 1/20/89
GOAL/DATE

Laurence S. Costin
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9. _____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____ See attached _____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

<u></u> APPROVING MANAGER'S SIGNATURE	<u>1/26/89</u> DATE
---	------------------------

J. L. King, TAR Chairman
MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Lawrence S Costin [Redacted] Date Prepared 1/6/88
(Print Name) (SSN)

ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF T.H. I Design

You are assigned to complete the following specialty training by 1/6/88
(Date)

Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>LC</u>	<u>1/1/88</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>MC</u>	<u>1/1/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Jerry L. King T.A.R. Chairman
(Print Name) (Title)
[Signature] January 6, 1989
(Signature) (Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have c.4-18 and Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 1/5/89
GOAL/DATE

Bruce Crowe has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

<u></u>	<u>1/26/89</u>
APPROVING MANAGER'S SIGNATURE	DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Bruce Crowe _____ Date Prepared 12/ /88
(Print Name) (SSN)

ASSIGNMENT/ACTIVITY Technical Assessment Review-ESF Title I Design

You are assigned to complete the following specialty training by 12/ /88
(Date)

Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>BMC</u>	<u>1-5-89</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>BMC</u>	<u>1-4-89</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Jerry L. King _____ Chairperson, T.A.R.
(Print Name) (Title)
Jerry L. King _____ January 5, 1989
(Signature) (Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have read Rev. 0. C.4-21

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Sandra Doty has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWT Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

	1/26/89
APPROVING MANAGER'S SIGNATURE	DATE

J. L. King, TAR Chairman
MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

(13)

Duty = SAIC/Golden, CO; Technical Support to USGS

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/T&MS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: SANCOS DOTY [REDACTED] Date Prepared 12/10/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF Title I DesignYou are assigned to complete the following specialty training by 12/19/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>SGD</u>	<u>12/19/88</u>
<u>---</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>SGD</u>	<u>12/19/88</u>
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Daniel C. Gillies
(Print Name)

Assoc. Chief,
Nuclear Hydrol. Prog. - USGS
(Title)

Daniel C. Gillies
(Signature)

12-22-88
(Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have been Rev. 0. C.4-24

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

W. Arch Girdley

(NAME)

has studied the following topics:


	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recomm- endation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____


1/26/89

_____ APPROVING MANAGER'S SIGNATURE DATE

J. L. King, TAR Chairman

_____ MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel .

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: W. ARCH GIRDLEY [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>WAG</u>	<u>12-13-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: W. ARCH GIRDLEY [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>WAG</u>	<u>12/19/88</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

2. Attend the following special training course(s):

<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

[Signature]
(Signature)

T.A.R. Chairperson
(Title)

December 19, 1988
(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8; it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATEErnest L. Hardin
(NAME)

has studied the following topics:


	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9. _____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____ See attached _____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

<u></u>	<u>1/26/89</u>	<u>DATE</u>
APPROVING MANAGER'S SIGNATURE		
J. L. King, TAR Chairman	MANAGER'S NAME AND TITLE (typed)	

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Ernest Hardin [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>ELH</u>	<u>12-13-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Ernest Hardin [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>ELH</u>	<u>12-19-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

T.A.R. Chairperson
(Title)

Jerry L. King
(Signature)

December 19, 1988
(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 17

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

John Jardine has studied the following topics:
(NAME)

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1. _____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2. _____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3. _____	<u>NNWSI Project Plan</u>	_____	_____	_____
4. _____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5. _____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6. _____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7. _____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: JOHN FARDINE [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by 12/13/88
Design (Date)Completion of this training assignment is a prerequisite to your performance
of work as a T.A.R. Team Member in the above activity.
(SSN, 12/10/88)

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
QMP-02-08	Technical Assessment Review	0	JAF.	12/16/88
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
December 17, 1988
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: JOHN JARDINE [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training ^{12/19/88} assignment is a prerequisite to your performance of work as a T.A.R. ^{COMMITTEE} Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>JAG</u>	<u>12/19/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Keith M. Kersch
(NAME)

has studied the following topics:


	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommenda- tion of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

	1/26/89
APPROVING MANAGER'S SIGNATURE	DATE
J. L. King, TAR Chairman	
MANAGER'S NAME AND TITLE (typed)	

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: KEITH M. KERSCH [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100, Title IYou are assigned to complete the following specialty training by Design 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JK</u>	<u>12/12/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: KEITH KERSCH [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>KMIL</u>	<u>12/15/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

T.A.R. Chairperson
(Title)

[Signature]
(Signature)

December 15, 1988
(Date)

* The initial TAR Plan was issued inadvertently ~~issued~~ as Rev. 8; C.4-40
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Jeffrey K. Kimball has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recomm- endation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9. _____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel .

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Jeffrey K Kimball
(Print Name)

(SSN)

Date Prepared 12/13/88ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by Design 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JKK</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)

December 13, 1988
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Jeffrey K Kimball [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>JKK</u>	<u>12/19/88</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. Attend the following special training course(s):

<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8; it should have read Rev. 0. C.4-44

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 1/4/89
GOAL/DATEJerry L. King
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommenda- tion of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Jean L. Yunker
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Jerry L. King [REDACTED] Date Prepared 1/4/89
(Print Name) (SSN)ASSIGNMENT/ACTIVITY QALA for ESF Design Acceptability AnalysisYou are assigned to complete the following specialty training by 1/4/89
(Date)Completion of this training assignment is a prerequisite to your performance of work as an assigner of QA levels for in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or _____, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-06</u>	<u>Assignment of Quality Assurance Levels</u>	<u>0</u>	<u>JK</u>	<u>1/4/89</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: <u>Jean L. Younker</u>	<u>Mgr., T&MSS Tech. Evaluation Dept.</u>
(Print Name)	(Title)
<u>4 Collins L. Howard</u>	<u>4/1/89</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Jerry L. King [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/13/88,
(Date)Completion of this training assignment is a prerequisite to your performance of work as a Chairperson in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Secretary, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-03-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JK</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Jean L. Younker Department Manager
(Print Name) (Title)

Jean L. Younker 12-13-88
(Signature) (Date)

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Edward M. Kwicklis has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommenda- tion of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----


APPROVING MANAGER'S SIGNATURE

J. L. King, TAR Chairman

1/26/89

DATE

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/TMSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Edward M. Kwickus [REDACTED] Date Prepared 12/10/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF Title I DesignYou are assigned to complete the following specialty training by 12/19/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>E.M.K.</u>	<u>12/19/88</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>E.M.K.</u>	<u>12/19/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

T.A.R. Chairperson Jerry L. King T.A.R. Chairperson
~~Manager~~ (Print Name) (Title)
Jerry L. King December 19, 1988
(Signature) (Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have C.4-51

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATERichard C. Lee
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached

_____	_____	_____
_____	_____	_____
_____	_____	_____

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel .

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Richard C. Lee [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>RCL</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction..

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Richard C. Lee [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>RCL</u>	<u>12/15/88</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. Attend the following special training course(s):

<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 15, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8; it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Robert A. Levich
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recomm- endation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____


1/26/89

 APPROVING MANAGER'S SIGNATURE DATE

J. L. King, TAR Chairman

 MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: ROBERT A. LEVICH [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>UAL</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Robert A. Levich [REDACTED] Date Prepared 12/15
 (Print Name) (SSN)

ASSIGNMENT/ACTIVITY ESF Title I Design Acceptability Analysis -
Technical Assessment Review
 You are assigned to complete the following specialty training by 12/15
 (Date)

Completion of this training assignment is a prerequisite to your performance of work as a _____ in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
 (Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
	<u>T.A.R. Plan</u>	<u>8*</u>	<u>[Signature]</u>	<u>12/15/88</u>

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King T.A.R. Chairperson
 (Print Name) (Title)
[Signature] December 20, 1988
 (Signature) (Date)

* The initial TAR Plan was inadvertently issued as Rev. 8, it should have read Rev. 0. c.4-59

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/13/88
GOAL/DATE

Mike Lugo has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPD Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: MIKE LUGO [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>ML</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: MIKE LUGO [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>ML</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Joshua D. Marvil
(NAME)

has studied the following topics:


	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

-----	See attached	-----	-----	-----
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----



 APPROVING MANAGER'S SIGNATURE

 1/26/89

 DATE

J. L. King, TAR Chairman

 MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

(13)

Marvil = SAIC/Golden, CO; Technical Support to USGS
N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/TMSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: JOSHUA D. MARVIL
(Print Name)[REDACTED]
(SSN)Date Prepared 12/10/88ASSIGNMENT/ACTIVITY Technical Assessment Review-ESF Title I DesignYou are assigned to complete the following specialty training by 12/19/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>SDM</u>	<u>12/19/88</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>Jon</u>	<u>12/17/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Daniel C. Gillies
(Print Name)Assoc. Chief,
Nuclear Hydrol. Prog.-USGS
(Title)Daniel C. Gillies
(Signature)12-22-88
(Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have
vered Rev. 0. C.4-66

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

August C. Matthusen

(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual, Section 3.0</u>)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____ See attached _____

J. L. King _____
 APPROVING MANAGER'S SIGNATURE 1/26/89 DATE

J. L. King, TAR Chairman

 MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: AUGUST C. MATTHUSEN ~~XXXXXXXXXX~~ Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1007, Title IYou are assigned to complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-03</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>ACM</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: AUGUST C. MATHUSEN [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>ACM</u>	<u>12/15</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/15/88
(Date)

* The initial TAR Plan was issued inadvertently issued as Rev. 8; C.4-70
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Clifford Noronha

(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9. _____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____	_____	_____	_____
12. _____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

See attached

 1/26/89
 APPROVING MANAGER'S SIGNATURE DATE

J. L. King, TAR Chairman

 MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: CLIFFORD NORONHA [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 1002 Title IYou are assigned to complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>CJN</u>	<u>12-15-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/15/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/TAMSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: CLIFFORD NORONHA [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>---</u>	<u>T.A.R. Plan</u>	<u>8th</u>	<u>CTN</u>	<u>12-15-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

T.A.R. Chairperson
(Title)

[Signature]
(Signature)

December 15, 1988
(Date)

* The initial TAR Plan was issued inadvertently ~~incorrect~~ as Rev. 8; it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Joseph V. Prizio

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

(13)

Prizio = U.S. Bureau of Reclamation, YMP, Denver, Co

N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/T&MS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: JOSEPH V. PRIZIO _____ Date Prepared 12/10/88
(Print Name) (SEN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF Title I DesignYou are assigned to complete the following specialty training by 12/19/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JVP</u>	<u>19-Dec-88</u>
<u>---</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>JVP</u>	<u>19-Dec-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Daniel C. Gillies
(Print Name)Assoc. Chief,
Nuclear Hydrol. Prog. - USGS
(Title)Daniel C. Gillies
(Signature)12-22-88
(Date)* Initial TAR Plan was inadvertently resub as Rev. 8; should have C.4-77
used Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/20/88
GOAL/DATE

Dermot M. Ross-Brown
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: DERMOT M ROSS-BROWN [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
QMP-C2-02	Technical Assessment Review	0	DL-B	12/13/88
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: Dermot Ross-Brown [REDACTED] Date Prepared 12/20/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY ESF Title I Design Acceptability AnalysisYou are assigned to complete the following specialty training by 12/20/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or _____, as directed.
(Team leader/instructor)
T.A.R. Chairperson

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
	T.A.R. Plan	8*	DRB	12/20/88

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Jerry L. King T.A.R. Chairperson
(Print Name) (Title)
Jerry L. King December 20, 1988
(Signature) (Date)

* The initial TAR Plan was inadvertently issued as Rev. 8; it should have read Rev. 0. JD C.4-81

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Scott Sinnock has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9.	_____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____ See attached _____

J. L. King
 APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Scott Sinnock [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by Design 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-03</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>SS</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Scott Sinnock [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>SS</u>	<u>12/17/88</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

2. Attend the following special training course(s):

<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Joe R. Tillerson has studied the following topics:
(NAME)

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____ See attached _____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

J. L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: JOE R. TILLERSON
(Print Name)

(SSN)

Date Prepared 12/13/88ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>JRT</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)

12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Jerry L. King [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>[Signature]</u>	<u>12/15/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 17, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently issued as Rev. 8; C.4-89
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Robert C. Trautz

(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual, Section 3.0</u>)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recomend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPO Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

 _____ See attached _____

 APPROVING MANAGER'S SIGNATURE 1/26/89
 _____ DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
 Personnel

Copies to:
 Manager's Personnel File
 Quality Assurance
 Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

(13)

Trantz = USGS, Nuclear Hydrology Program, Denver, CO
N-AD-077

YUCCA MOUNTAIN PROJECT OFFICE/TMSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: ROBERT C. TRANTZ [REDACTED] Date Prepared 12/10/88
(Print Name) (ESN)

ASSIGNMENT/ACTIVITY Technical Assessment Review-ESF Title I Design

You are assigned to complete the following specialty training by 12/19/88
(Date)

Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMAP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>RC</u>	<u>12/17/88</u>
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>RC</u>	<u>12/17/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Manager: Daniel C. Gillies
(Print Name)

Assoc. Chief,
Nuclear Hydrol. Prog.-USGS
(Title)

Daniel C. Gillies
(Signature)

12-22-88
(Date)

* Initial TAR Plan was inadvertently issued as Rev. 8; should have read Rev. 0

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Scott G. Van Camp
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures (<u>Familiari- zation Manual, Section 3.0</u>)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers' Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

----- See attached -----

Jerry L. King
APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

Jerry L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: SCOTT G. VAN CAMP [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-08</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>SK</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: SCOTT G. VAN CAMP [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>SVC</u>	<u>12/15</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

Jerry L. King
(Signature)

T.A.R. Chairperson
(Title)

December 17, 1988
(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/19/88
GOAL/DATE

Michael D. Voegele
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual, Section 3.0</u>)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____



APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

J. L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: Michael D. Voegele [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title IYou are assigned to complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-02-03</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>MDV</u>	<u>12-13-88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)
[Signature]
(Signature)

T.A.R. Chairperson
(Title)
12/13/88
(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: Michael Osbegele [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>MBV</u>	<u>12-19-88</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

2. Attend the following special training course(s):

<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>December 19, 1988</u>
(Signature)	(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

YUCCA MOUNTAIN PROJECT/T&MSS TRAINING ASSIGNMENTS

Employee Name: Michael D. Voegelé SSN [REDACTED] Date 1/5/89
 Job Position: APM for Site Evaluation & Compliance Organization T&MSS
 Manager Neal Carter Neal S. Carter
 (Print Name) (Signature)

Required Classroom Training Courses (to be completed when available):

Required Reading Assignment

Complete Reading by 1/5/89
(date)

PROCEDURE NUMBER	REV.	TITLE	READ	DATE	INTL
QMP-01-01	1	ORGANIZATION	_____	_____	_____
QMP-01-02	0	STOP WORK	_____	_____	_____
QMP-02-01	1	QUALIFICATION & TRAINING	_____	_____	_____
QMP-02-02	1	QUALIFICATION OF QA AUDIT PERSONNEL	_____	_____	_____
QMP-02-06	0	ASSIGNMENT OF QALAs	✓	1-5-89	not
QMP-02-08	0	TECHNICAL ASSESSMENT REVIEW	_____	_____	_____
QMP-03-01	0	PEER REVIEW	_____	_____	_____
QMP-03-02	*	SCIENTIFIC INVESTIGATION	_____	_____	_____
QMP-04-01	0	PROCUREMENT DOCUMENT CONTROL	_____	_____	_____
QMP-05-01	1	PREPARATION & CONTROL OF QMPs	_____	_____	_____
QMP-05-02	0	PREPARATION & CONTROL OF BTPs	_____	_____	_____
QMP-05-03	0	PREPARATION & CONTROL OF QAP/QAPP	_____	_____	_____
QMP-06-02	*	DOCUMENT CONTROL	_____	_____	_____
QMP-06-03	1	DOCUMENT REVIEW/ACCEPTANCE/APPROVAL	_____	_____	_____
QMP-07-03	0	CONT. OF PURCHASED ITEMS & SERVICES	_____	_____	_____
QMP-15-01	1	CONTROL OF NON-CONFORMANCES	_____	_____	_____
QMP-15-02	0	UNUSUAL OCCURRENCE	_____	_____	_____
QMP-16-01	0	CORRECTIVE ACTION	_____	_____	_____
QMP-16-02	2	TREND ANALYSIS	_____	_____	_____
QMP-16-03	0	SDR SYSTEM	_____	_____	_____
QMP-17-01	*	QA RECORDS	_____	_____	_____
QMP-18-01	3	AUDIT SYSTEM FOR YUCCA MOUNTAIN PROJECT	_____	_____	_____
QMP-18-02	1	SURVEILLANCES	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

[illegible]

I have read the documents indicated above and understand how they impact my job assignment.

Signed: Michael O Vreys Date 1-5-89
(Employee)

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/15/88
GOAL/DATE

Charles F. Voss
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.	_____	SAIC policies and procedures. (<u>Familiari- zation Manual</u> , Section 3.0)	_____	_____	_____
2.	_____	Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)	_____	_____	_____
3.	_____	<u>NNWSI Project Plan</u>	_____	_____	_____
4.	_____	Nuclear Waste Policy Act of 1982	_____	_____	_____
5.	_____	10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"	_____	_____	_____
6.	_____	10 CFR 960, "General Guidelines for Recomm- ation of Sites for Nuclear Waste Repositories"	_____	_____	_____
7.	_____	40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"	_____	_____	_____

*See Section 9.0 of Familiarization Program Manual for locations.

DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
---	--------	-------------------	----------------------	-------------------

8. _____	NVO-196-17, NNWSI Project Quality Assurance Plan	_____	_____	_____
9. _____	NVO-196-18, WMPD Quality Assurance Program Plan	_____	_____	_____
10. _____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11. _____	T&MSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12. _____	Cost Account Managers' Handbook	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____


 APPROVING MANAGER'S SIGNATURE

 1/26/89
 DATE

J. L. King, TAR Chairman
 MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/TAMSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: CHARLES F. VOSS [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100, Title IYou are assigned to ^{Design}complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>QMP-C2-02</u>	<u>Technical Assessment Review</u>	<u>0</u>	<u>CV</u>	<u>12/13/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber 2TO: CHARLES F. VOSS [REDACTED] Date Prepared 12/15/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100% Title I DesignYou are assigned to complete the following specialty training by 12/15/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
<u>—</u>	<u>T.A.R. Plan</u>	<u>8*</u>	<u>CV</u>	<u>12/15/88</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
(Print Name)

[Signature]
(Signature)

T.A.R. Chairperson
(Title)

December 19, 1988
(Date)

* The initial TAR Plan was issued inadvertently as Rev. 8;
it should have read Rev. 0.

FAMILIARIZATION PROGRAM FORM

(Instructions on Reverse)

Goal for completion of the Familiarization Program 12/20/88
GOAL/DATEWilliam E. Wilson
(NAME)

has studied the following topics:

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
1.		SAIC policies and procedures (<u>Familiari- zation Manual</u> , Section 3.0)			
2.		Background and purpose of the Nuclear Waste Policy Act, 1982 (<u>Nuclear Waste Primer</u>)			
3.		<u>NNWSI Project Plan</u>			
4.		Nuclear Waste Policy Act of 1982			
5.		10 CFR 60, "Disposal of High-Level Radioactive Wastes in Geologic Repositories"			
6.		10 CFR 960, "General Guidelines for Recommend- ation of Sites for Nuclear Waste Repositories"			
7.		40 CFR 191, "Environmental Standards for Management of Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste"			

*See Section 9.0 of Familiarization Program Manual for locations.

	DOCUMENT LOCATION (LIB, PM, DPM, or DM)*	TOPICS	REQUIRED (Y/N)	EMPLOYEE INITIALS	DATE COMPLETED
8.	_____	NVO-196-17, <u>NNWSI Project Quality Assurance Plan</u>	_____	_____	_____
9.	_____	NVO-196-18, <u>WMPO Quality Assurance Program Plan</u>	_____	_____	_____
10.	_____	NNWSI Administrative Procedures: _____ _____ _____	_____	_____	_____
11.	_____	TAMSS Administrative Procedures: _____ _____ _____	_____	_____	_____
12.	_____	<u>Cost Account Managers'</u> <u>Handbook</u>	_____	_____	_____

OTHER DOCUMENTS, AS REQUIRED:

_____	See attached	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____


APPROVING MANAGER'S SIGNATURE

1/26/89

DATE

Jerry L. King, TAR Chairman

MANAGER'S NAME AND TITLE (typed)

Original to:
Personnel

Copies to:
Manager's Personnel File
Quality Assurance
Correspondence Control Facility

*See Section 9.0 of Familiarization Program Manual for locations.

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENTNumber N/ATO: William E. Wilson [REDACTED] Date Prepared 12/13/88
(Print Name) (SSN)ASSIGNMENT/ACTIVITY Technical Assessment Review - ESF 100, Title IYou are assigned to Design complete the following specialty training by 12/13/88
(Date)Completion of this training assignment is a prerequisite to your performance of work as a T.A.R. Team Member in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
(Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
QMP-02-08	Technical Assessment Review	0	WES	12-13-88
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

<u>Jerry L. King</u>	<u>T.A.R. Chairperson</u>
(Print Name)	(Title)
<u>[Signature]</u>	<u>12/13/88</u>
(Signature)	(Date)

YUCCA MOUNTAIN PROJECT OFFICE/T&MSS

SPECIAL TRAINING ASSIGNMENT

Number _____

TO: William E. Wilson [REDACTED] Date Prepared 12-20-88
 (Print Name) (SSN)

ASSIGNMENT/ACTIVITY ESF Title I Design Acceptability Analysis -
Technical Assessment Review

You are assigned to complete the following specialty training by _____
 (Date)

Completion of this training assignment is a prerequisite to your performance of work as a _____ in the above activity.

1. Complete indoctrination/training as indicated below. Return this sheet to the Training Division or T.A.R. Chairperson, as directed.
 (Team Leader/Instructor)

READING ASSIGNMENT(S)

Doc. No.	Title	Rev.	Initials	Date
	<u>T.A.R. Plan</u>	<u>8*</u>	<u>WES</u>	<u>12-20-88</u>

2. Attend the following special training course(s):

(Title)	(Date)	(Time)	(Location)

The above individual has been interviewed by me and has completed this assignment to my satisfaction.

Jerry L. King
 (Print Name)

T.A.R. Chairperson
 (Title)

[Signature]
 (Signature)

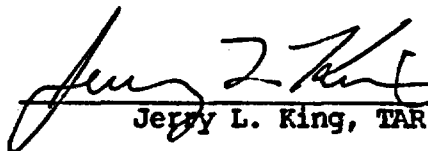
December 20, 1988
 (Date)

* The initial TAR Plan was inadvertently issued as Rev. 8, it should have read Rev. 0. C.4-110

2A

DATE: February 2, 1989
FROM: Jerry L. King
TO: TAR File
SUBJECT: WAIVER OF TRAINING ON FINAL TAR PLAN

As described in the Introduction (Section 1.3.2), the TAR Plan was revised after the TAR was initiated as a corrective action which was taken in response to a Standard Deficiency Report on the need to apply document control to the Plan. Review activities were nearly completed when the revised TAR Plan was finalized, and the final TAR Plan reflects the review methodologies actually employed in the TAR. The TAR Chairperson, therefore, waived training on the final TAR Plan.

 2/2/89

Jerry L. King, TAR Chairperson

APPENDIX C-5

Questionnaire for Documenting Independence
of TAR Team Members

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: CRAIG B. BENTLEY

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

I coordinated the review (and signed the review forms) of the ESF-SORD, although the actual review was performed by people under my direction.

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Craig B. Zimby

Date:

12/20/08

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Felton W. Bingham

Review function(s): Performance assessment/evaluation specialist

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

I was not a primary author of Section 8.4.3, but I assisted in preparing responses to reviewers' comments on it.

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None, unless the team that prepared responses to reviewers' comments on SCP Section 8.4.3 is considered a "committee."

Signature: William W. Bingham
Date: December 20, 1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *RALPH Cady*

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE.

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE.

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE.

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE.

Signature:

Ralph Cady

Date:

12/22/1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *Paul L. Cloke*

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Paul F. Clope

Date:

12/29/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Laurence S. Costin

Review function(s): Geotechnical Engineer

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE — However I have authored reports (listed below) that have been used to support the evaluation of the title I design.

SAND 88-2785

SAND 87-1575

SAND 87-2699

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE — However, I have reviewed reports (listed below) that may be used by the panel to assess the design of the ESF.

SAND 87-1433

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

Primary author of sections ~~8.4.3.2~~ ^{1/6/89}
8.4.2.3.6 and parts of sections 8.4.2.3.1

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Lauren Scholt

Date:

1/6/89.

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *BRUCE Crowe*

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Brune Crowe

Date: *1-4-89*

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: SANDRA DOTY

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

FERNANDEZ AND OTHERS (1988) "REVIEW OF SELECTED ANALYSES
TO EVALUATE THE EFFECT OF THE
EXPLORATORY SHAFTS ON REPOSITORY
PERFORMANCE AT YUCCA MOUNTAIN"

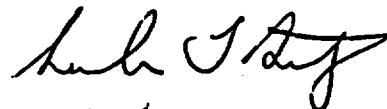
3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

BULK PERMEABILITY TEST, SCP SECTION 8.3.1.2.2.4.3

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:



Date:

12/27/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: W. ARCH GIRDLEY

Review function(s): GEOLOGIST

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature: *W. A. Dirdley*

Date: *12-20-88*

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: ERNEST HARDIN

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

"Exploratory Shaft Location Documentation Report" by
Gnirk, Hardin & Voegelé ; DOE-NV-88-12-25
(in prep.)

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None.

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

8.4.2.1 Representativeness of site char. program planned, incl. relationship of ESF to Surface based testing

8.4.2.2 Description of Surface based testing & associated construction / test controls, & test interference.

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None.

Signature:

Edw. Hardin

Date:

12/26/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: KEITH KERSCH

Review function(s): Hydrology

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

Management Reviews were conducted on reports that were used in ESF Design:

- (1) Peterson, Eaton, Russo, Lewin; "Technical Correspondence of an Evaluation of the Hydrologic Effects of Exploratory Shaft Construction at Yv."
- (2) Bodvarsson, Niemi, Spencer, Ahtayuka; "Preliminary Calculations of the Effects of Air and Liquid Water Drilling on Moisture Conditions in Unsaturated Rock."
- (3) Kwicklis & Hoxie; "Numerical Simulation of Liquid Water Infiltration into Fractured, Welded Tuff" (abstract)

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature: *Keith M. Kersch*

Date: *12/22/88*

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Jeff Kimball

Review function(s): Alternative Location Analysis

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

Reviewed Gnirk Voegde Horden Report - History
of ESF Location

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

IG Member - Reviewed all of the
SCP including 8.4
Some comments resulted in text
revision v1-3 pgs including 8.4

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Date:

Jeffrey K. Kuhl
12/20/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *Jerry L. King*

Review function(s): *Tech. Assess. Review Chairperson*

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

James Z. King

Date:

December 20, 1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Edward M. Kwicklis

Review function(s): Hydrologist

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate. None, BUT I CO-AUTHORED THE FOLLOWING RESOURCE DOCUMENT:

Kwicklis E.M., and L.T. Hoxie, 1988
NUMERICAL SIMULATION OF LIQUID WATER INFILTRATION INTO
FRACTURED WELLS: TUFF
WORKSHOP II ON FLOW AND TRANSPORT THROUGH UNSATURATED
FRACTURED ROCK AS RELATED TO A HIGH-LEVEL NUCLEAR WASTE
REPOSITORY (ABSTRACT) UNIVERSITY OF ARIZONA, TUCSON, ARIZ

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None, BUT I REVIEWED THE FOLLOWING RESOURCE DOCUMENT:

BOLVANDSON, G.S., A. NIEKE, A. SPRINGER, AND M. ATTANYAKTE,
1988. PRELIMINARY CALCULATIONS OF THE EFFECTS OF AIR AND
LIQUID WATER-DRILLING ON MOISTURE CONDITIONS IN UNSATURATED
ROCKS, LBL-25073, LAWRENCE BERKELEY LABORATORY,
BERKELEY, CALIF.

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature: *Edmund M. Kunchlin*
Date: 12/20/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *Richard C. Lee*

Review function(s): *Secretary*

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Richard C. Lee

Date:

20 December, 1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: MIKE LUGO

Review function(s): REGULATORY SPECIALIST

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE. ONLY PARTICIPATED IN PARTIAL REVIEW OF
SCP SECTION 8.4 (8.4.1, 8.4.2)

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE.

Signature:

Miguel Lopez

Date:

12/20/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: JOSHUA D. MARVIL

Review function(s): Reviewed several sections of Fernandez et al (1988)
Checked validity of assumptions, appropriateness of models used, and conclusions.
Compared to Section 8.4 of SCP.

1. List the titles of any reports you have authored or co-authored on the
subject of ESF Title I design (exclude any work done on the SCP). Please
include the author list and the document number when appropriate. Enter "None"
if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have
reviewed, excluding the SCP (include both policy and technical reviews). If
your review of a report was limited, describe the part or aspect of the report
that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:

John D. Hain

Date:

12-27-88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: AUGUST C. MATTHUSEN

Review function(s): Technical Assessment Review Team Leader, Data
Certification Task.

1. List the titles of any reports you have authored or co-authored on the
subject of ESF Title I design (exclude any work done on the SCP). Please
include the author list and the document number when appropriate. Enter "None"
if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have
reviewed, excluding the SCP (include both policy and technical reviews). If
your review of a report was limited, describe the part or aspect of the report
that you reviewed. Enter "None" if appropriate.

POLICY REVIEWS ON THE FOLLOWING:

Reda, 1986 INFLUENCE OF TRANSVERSE MICROFRACTURES ON THE
IMBIBITION OF WATER INTO INITIALLY DRY TUFFACEOUS ROCK

Hopkins et al., 1987 EFFECT OF DRIFT VENTILATION ON REPOSITORY
HYDROLOGY AND RESULTING SOLUTE TRANSPORT IMPLICATIONS

DeGabriele and Wu - PROBABLE MAXIMUM FLOOD (PMF) CONTROL
STUDY

C.5-3

PART OF Fernandez et al - Analysis to evaluate the effect of the
exploratory shaft on repository performance at Yucca Mountain

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

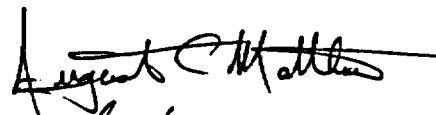
None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Date:


12/20/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: CLIFFORD J. NORONHA

Review function(s): Performance Assessment / Hydrogeologist.

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

W. Horvath

Date: 21 - Dec - 1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Joseph Prizio

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate. None.

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate. None

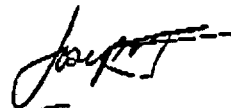
3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:



(JOSEPH PRI)

Date:

JAN 4, 1969

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: DERMOT ROSS-BROWN

Review function(s): MINING ENGINEER

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

Technical Assessment Review of ESF Title I Design (50% completion)
Technical Assessment Review of ESF Title I Design (100% completion)
ESF - SORB (Version of 11/1/88) - Licensing Review

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

Alvin H. B...

Date:

12/20/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *Scott Sinnock*

Review function(s): *Performance Assessment, ESF Location Comparison*

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None


3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:



Date:

12/20/85

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: JOE R. TILLERSON

Review function(s): GEOTECHNICAL ENGINEER

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE - However, in fulfilling my duties as supervisor of the underground design activities for the repository I have reviewed (but not authored) several of the reports that are being used by the panel to assess the design of the Exploratory Shaft facility (see attached list of analyses I have reviewed).

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

I was the original author of an introductory 10 page section (8.4.1.2) on the incorporation of IOCFE Part 60 in the development of the site Characterization program. I was co-chairman of the working group responsible for SCP Section 8.4. My efforts in that capacity were related to planning, evaluating, commenting on and integrating comments into numerous sections of SCP Section 8.4 but I was not the author of any of those sections (except 8.4.1.2).

Additionally, I have reviewed and modified numerous sections of the SCP in section ~~8.3~~^{7.7} 8.3, Chapter 2, and Chapter 6 that form the basis for many of the criteria used to judge the ESF design in this review.

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:

Joe R. Tillerson
Joe R. Tillerson

Date:

12-21-88

Principal Support Documents Reviewed by Joe Tillerson

SAND85-0598
SAND83-0372
SAND86-7005
SAND86-1250
SAND88-2785

SAND86-7001
SAND83-0030
SAND83-7451
SAND87-1575
SAND84-2641(one of 3 compilers)

SAND84-7208
SAND84-7213
SAND84-2354
SAND87-2699

Joe R. Tillerson 12-21-88

Trantz

Page 1 of 2

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: Robert Trantz

Review function(s): hydrologist/hydrogeologist

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

RADIAL BOREHOLE TEST

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:

Date:

Robert C. Smith
12/23/08

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: SCOTT G. VAN CAMP

Review function(s): ALTERNATIVE SHAFT LOCATIONS SUB-COMMITTEE

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

NONE

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

(I DO NOT RECALL NAME OF COMMITTEE)

THIS COMMITTEE DID NOT REVIEW ESF TITLE I DESIGN, BUT WE REVIEWED THE FLOWDOWN FROM 10 CFR 60 INTO THE SDRD AND INTO PORTIONS OF F+S AND H+N DESIGN DOCUMENTS. MY ROLE WAS TO HELP DETERMINE IF THE 10 CFR 60 REQUIREMENTS WERE APPLICABLE TO THE VARIOUS DOCUMENTS AND IF SO WERE THEY ADDRESSED.

Signature: Scott G. U. Clark
Date: 12/26/88

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *Michael D. Voegelé*

Review function(s): *1) Requirements/ Criteria Development; and
2) Design Adequacy Review.*

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

*(however, co-author of historical synopsis of
Project correspondence related to shaft location
Amirk, Hardin and Voegelé; "Exploratory Shaft
Location Documentation Report" 0067NV 88-1225)*

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

None specifically related to ESF design, authored several introductory sections of SCP section 8.4 and involvement in SCP reviews of section 8.4

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

M D Vazquez

Date:

Dec 21, 1988

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: *CHARLES F. VOSS*

Review function(s): *TAR / PART I - ELEMENT 4*

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

NONE

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

NONE

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

8.4.2.1 *Rationale for planned testing*

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

NONE

Signature:

Charles F. Vance

Date:

12/20/88

Page 1 of 2

ESF Title I Design Acceptability Analysis Technical Assessment Review -
Questionnaire for documenting the independence of design review members.

(Please Print)

Name: William E. Wilson

Review function(s):

1. List the titles of any reports you have authored or co-authored on the subject of ESF Title I design (exclude any work done on the SCP). Please include the author list and the document number when appropriate. Enter "None" if appropriate.

None

2. List the titles and authors of reports on ESF Title I design which you have reviewed, excluding the SCP (include both policy and technical reviews). If your review of a report was limited, describe the part or aspect of the report that you reviewed. Enter "None" if appropriate.

None

Page 2 of 2

3. If you have authored any sections of the SCP related to ESF Title I Design, please list the SCP sections and the subject. Enter "None" if appropriate.

Parts of Chapter 3, Hydrology
Parts of Chapter 5.3.2, Geo-hydrology Program
Parts of Chapter 5.4, Planned site preparation activities

4. List any committees you previously belonged to that have reviewed ESF Title I design and your role on each committee. Enter "None" if appropriate.

None

Signature:

William E. Nelson

Date:

1-31-89

APPENDIX C-6

Standard Deficiency Reports and Observations

1 NO STANDARD DEFICIENCY REPORT

N-QA-038
3/87

Completed by Originating QA Organization	1 Date 12/21/88		2 Severity Level <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3		Page 1 of 2	
	3 Discovered During OMP-SR-89-003		3a Identified By K. Sommer T. Noland		3b Branch Chief Concurrence Date	
	4 SDR No. 271		Rev. 0			
	5 Organization YMPO		6 Person(s) Contacted J. King, R. Levich		7 Response Due Date is 20 Working Days from Date of Transmittal	
Completed by Organization in Block 5	8 Requirement (Audit Checklist Reference, if Applicable) NNWSI/88-9, Rev. 2, Section 2, Paragraph 5.1.3, states in part "Prior to assigning personnel to perform activities affecting quality, they shall be indoctrinated as to the purpose, scope, methods of implementation, and applicability of the following documents (cont.)"					
	9 Deficiency The Technical Assessment Review (TAR) chairman for the Exploratory Shaft Facility (ESF) Title I Design Acceptability Analysis and Comparative Evaluation did not have documented indoctrination or training to NNWSI-SOP-02-02, Rev. 1, "Assignment of Quality Assurance Levels to NNWSI Activities and Items." The TAR chairman (cont.)					
	10 Recommended Action(s): <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Investigative <input checked="" type="checkbox"/> Corrective Provide a description of both the remedial and corrective actions to be taken to address the deficiency and prevent recurrence. In addition, provide a cause for the condition(s) noted and the effective dates when corrective action (cont.)					
	11 QAE/Lead Auditor Date <i>Wendell B. Mares 12/28/88</i>		12 Branch Manager Date <i>W. Noland 12/28/88</i>		13 Project Quality Mgr. Date <i>Voltaire for Jim Blaylock 12/28/88</i>	
Completed by Orig. QA Org.	14 Remedial/Investigative Action(s) Objective evidence documenting that the TAR Chairperson has read and understands QMP-02-06, Rev. 0, "Assignment of QA Levels," has been obtained. (The procedure cited in Block 8, NNWSI-SOP-02-02, Rev. 1, "Assignment of Quality Assurance Levels to NNWSI Activities and Items," has been superseded by QMP-02-06, Rev. 0.)					
	15 Effective Date 1/4/89					
	16 Cause of the Condition & Corrective Action to Prevent Recurrence The cause of the deficiency was an oversight by the TAR Chairperson in updating the appropriate indoctrination record following his reading of QMP-02-06, Rev. 0. There was no adverse impact on the quality of the preparation of the affected QALAS as a result of this documentation error					
	17 Effective Date 2/15/89					
Comp. by Orig. QA Org.	18 Signature/Date <i>Henry Z. King 1/24/89</i> <i>W. Noland 1/24/89</i>					
	19 Response <input checked="" type="checkbox"/> Accept <input type="checkbox"/> Amended <input type="checkbox"/> Reject Response		QAE/Lead Auditor/Date <i>W. Noland 2/16/89</i>		Branch Manager/Date <i>W. Noland 2/16/89</i>	
	20 Amended Response <input type="checkbox"/> Accept <input type="checkbox"/> Reject		QAE/Lead Auditor/Date		Branch Manager/Date	
	21 Verification <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		QAE/Lead Auditor/Date <i>W. Noland 2/17/89</i>		Branch Manager/Date <i>W. Noland 2/17/89</i>	
	22 Remarks See Page 3 for verification					
23 QA CLOSURE QAE/Lead Auditor/Date Branch Manager/Date POM/Date <i>W. Noland 2/17/89</i> <i>W. Noland 2/17/89</i> <i>James Blaylock 2/18/89</i>						



WMPO STANDARD DEFICIENCY REPORT CONTINUATION SHEET

N-QA-031
10/86

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Rev. 0

Page 1 of 1

8. cont.) (including changes thereto), as a minimum as they relate to the work to be accomplished."

Implementing procedures and work instructions (applicable to the individual's responsibilities."

In addition, paragraph 5.1.4 of the same document states in part, "Prior to assigning personnel to perform quality affecting activities, training, if needed, shall be conducted to gain the required proficiency."

9. cont.) had completed the WMPO Quality Assurance Level Assignment Sheet for this activity.

10. cont.) is to be completed.

Corrective Action to Preclude Recurrence - Mr. H. D. Voegele, Site Evaluation & Compliance Manager, shall issue a memo to his staff by 2/15/89, re-instructing affected personnel of the requirement that personnel shall be indoctrinated and, as appropriate, trained in accordance with QMP-02-31, Rev. 1, "Qualification, Proficiency, Indoctrination, and Training of Waste Management Project Office Personnel" Sections 5.3 and 5.4, prior to performing an activity affecting quality.

Completed by Originating QA Organization	1 Date 12/21/88		2 Severity Level <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3		Page 1 of 2
	3 Discovered During Document Review		3a Identified By K. Sommer T. Noland		3b Branch Chief Concurrence Date
	4 SDR No. 272		Rev. 0		
	5 Organization YMPO		6 Person(s) Contacted R. Levich, J. King		7 Response Due Date is 20 Working Days from Date of Transmittal
Completed by Organization in Block 5	8 Requirement (Audit Checklist Reference, if Applicable) NNWSI 88-9, Rev. 2, Section VI, Document Control states in part: (See attached...)				
	9 Deficiency See Page 2				
	10 Recommended Action(s) <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Investigative <input checked="" type="checkbox"/> Corrective Provide a description of both the remedial and corrective actions to be taken to address the deficiency and prevent recurrence. In addition, provide a cause for the condition(s) noted and the effective dates when corrective action is to be completed.				
	11 QAE/Lead Auditor Date <i>Wendell B. Marshall 12/25/88</i>		12 Branch Manager Date <i>W. J. for King 12/24/88</i>		13 Project Quality Mgr. Date <i>Jim Blaylock 12/28/88</i>
Completed by Org. QA Org.	14 Remedial/Investigative Action(s) The DAA TAR Plan will be reviewed and approved in accordance with QMP 06-03 (current revision) and will be controlled in accordance with the requirements of QMP 06-02 (current revision) prior to the conclusion of the TAR. Changes to the DAA TAR Plan that result from the QMP 06-03 review process, will be evaluated to determine if these changes affect the completed work of the TAR team. Where such changes to the TAR Plan affect completed work, this work will be revisited and (continued)				
	15 Cause of the Condition & Corrective Action to Prevent Recurrence The cause of this deficiency is procedural error. QMP 06-03 nor QMP 02-08 do not require a review of the TAR Notice (or supplemental plan). Therefore, the Plan was not subjected to processing in accordance with QMP 06-03 or QMP 06-02 as a document that affects a quality activity. An Interim Change Notice (ICN) to QMP 02-08 will be prepared and issued to correct this error. This ICN will adjust QMP 02-08 to require that the control of the TAR (continued)				
	16 Signature/Date <i>J. King 2/2/89</i> <i>R. Levich 02/02/89</i>				
	17 Effective Date 2/3/89		18 Effective Date 2/7/89		
Comp. by Org. QA Org.	19 Response <input checked="" type="checkbox"/> Accept <input type="checkbox"/> Amended Response <input type="checkbox"/> Reject		QAE/Lead Auditor/Date <i>T. Noland 2/7/89</i>		Branch Manager/Date <i>W. J. for King 2/7/89</i>
	20 Amended Response <input type="checkbox"/> Accept <input type="checkbox"/> Reject		QAE/Lead Auditor/Date		Branch Manager/Date
	21 Verification <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		QAE/Lead Auditor/Date <i>T. Noland 2/7/89</i>		Branch Manager/Date <i>W. J. for King 2/7/89</i>
	22 Remarks See page 3 for verification				
23 QA CLOSURE		QAE/Lead Auditor/Date <i>T. Noland 2/7/89</i>		Branch Manager/Date <i>W. J. for King 2/7/89</i>	PQM/Date <i>James Blaylock 2/6/89</i>

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WA 0 STANDARD DEFICIENCY REPORT
CONTINUATION SHEET

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8. Requirements:

1.1 The preparation, review, approval, and issuance of documents such as instructions, procedures, plans and drawings, including changes thereto, shall be controlled through the implementation of methods that assure that only correct documents are used. Document control shall be applied to the following:

- o Documents containing or specifying quality requirements.
- o Documents that prescribe activities affecting quality.

The document control system shall be documented, and the QA organization shall provide the appropriate review, resolution of comments, and concurrence with respect to quality-related aspects of the documents.

9. Deficiency:

The referenced requirement has not been addressed with the issuance of the DAA TAR dated 12/12/88 in the following areas:

- o The preparation, review, approval and issuance of the DAA TAR has not been controlled per the existing Project Office control system described in QMP-06-02, Document Control and QMP-06-03, Document Review/Acceptance/Approval. In that the DAA TAR is a document that prescribes activities affecting quality, it would appropriately need to be subjected to the existing programmatic process described in the referenced QMPs.
- o The DAA TAR, dated 12/12/88 was issued with a Rev. 8 designation; previous iterations of the TAR have not been subject to document control process described in NWWSI 88-9.
- o Resolution of QA comments, submitted by an informal process, was not complete upon issuance of DAA TAR on 12/12/88.

14. Remedial/investigative

adjusted in a manner that complies with changes to the TAR Plan. If changes to the TAR Plan do affect completed work, the required adjustments to the work will be documented in the Review Record Memorandum.

16. Cause

Notice and any supplemental plans meet the requirements of both QMP 06-03 and and QMP 06-02.

Completed by Originating QA Organization	1 Date <u>12/21/88</u>		2 Severity Level <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3		Page <u>1</u> of <u>2</u>
	3 Discovered During <u>YMP-SR-89-003</u>		3a Identified By <u>K. Sommer</u> <u>T. Noland</u>		3b Branch Chief Concurrence Date
	4 SDR No. <u>273</u>		Rev. <u>0</u>		
	5 Organization <u>WMFO</u>		6 Person(s) Contacted <u>J. King, R. Levich</u>		7 Response Due Date is <u>20 Working Days from</u> <u>Date of Transmittal</u>
Completed by Originating QA Organization	8 Requirement (Audit Checklist Reference, if Applicable) <u>NNWSI/88-9, Rev. 2, Section 2, Paragraph 2.2.1 states in part, "The basis for the selection of the Quality Assurance Level and assigned QA requirements shall be documented. The assigned Quality Assurance Levels and requirements must be submitted to the WMFO for review, (cont.)"</u>				
	9 Deficiency The WMFO Quality Assurance Level Assignment (QALA) Sheets for the Exploratory Shaft Facility (ESF) Title-I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations, WBS 1.2.6.1.1 had not been through the complete review and approval cycle prior to implementation of the activity. (Cont.)				
	10 Recommended Action(s): <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Investigative <input checked="" type="checkbox"/> Corrective Provide a description of both the remedial and corrective actions to be taken to address the deficiency and prevent recurrence. In addition, provide a cause for the condition(s) noted and the effective dates when corrective action is to be completed.				
Approved	11 QAE/Lead Auditor Date <u>Wendell B. Murrell 12/28/88</u>		12 Branch Manager Date <u>John King 12/28/88</u>		13 Project Quality Mgr. Date <u>Jim Blaylock 12/28/88</u>
Completed by Organization in Block 5	14 Remedial/Investigative Action(s) The appropriate QALAS has been completed and all necessary approvals obtained.				
	15 Effective Date <u>January 6, 1989</u>				
	16 Cause of the Condition & Corrective Action to Prevent Recurrence Cause of the Condition: The TAR Chairman was not aware that a QALA was necessary for a TAR and the QALA process was started late. The lack of an approved QALAS had no adverse impact on the quality of the TAR. Corrective Action to Prevent Recurrence: Reinstruction to staff from responsible Assistant Project Manager that QALAS must be approved in accordance with QMP-02-08 prior to commencing the activity or using the item which is addressed in the QALAS.				
Completed by Org.	17 Effective Date <u>2/15/89</u> by <u>2/15/89</u> .				
	18 Signature/Date <u>Wendell B. Murrell 1/1/89</u> <u>Walt A. Kirsch 1/24/89</u>				
	19 Response <input checked="" type="checkbox"/> Accept <input type="checkbox"/> Amend <input type="checkbox"/> Reject <input type="checkbox"/> Response		QAE/Lead Auditor/Date <u>T.W. Noland 2/16/89</u>		Branch Manager/Date <u>Walt A. Kirsch 2/16/89</u>
	20 Amended Response <input type="checkbox"/> Accept <input type="checkbox"/> Reject		QAE/Lead Auditor/Date		Branch Manager/Date
	21 Verification <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		QAE/Lead Auditor/Date <u>T.W. Noland 2/17/89</u>		Branch Manager/Date <u>Walt A. Kirsch 2/17/89</u>
Comp. by Orig. QA Org.	22 Remarks				
	23 QA CLOSURE QAE/Lead Auditor/Date <u>T.W. Noland 2/17/89</u> Branch Manager/Date <u>Walt A. Kirsch 2/17/89</u> PQM/Date <u>James Blaylock 2/16/89</u>				

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WMPO STANDARD DEFICIENCY REPORT
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8. (cont.) resolution of comments, and approval prior to implementation or use. This review and approval shall be performed by the WMPO PQM and appropriate Branch Chief."
9. (cont.) The QALA Sheets had not been approved by the Project Quality Manager.

YMPO STANDARD DEFICIENCY REPORT

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Completed by Originating QA Organization	1 Date 1/13/89		2 Severity Level <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3		Page 1 of 2	
	3 Discovered During YMP-SR-89-004		3a Identified By T. W. Noland		3b Branch Chief Concurrence Date	
	4 SDR No. 283		Rev. 0			
	5 Organization YMPO		6 Persons(s) Contacted J. King/R. Levich		7 Response Due Date is 20 Working Days from Date of Transmittal	
Completed by Organization in Block 5	8 Requirement (Audit Checklist Reference, if Applicable) QMP-02-08, Rev. 0, "Technical Assessment Review," Para. 5.4.1 states, "The review team members review the material and document their comments on Technical Assessment Review Comment Records. If a review team member has no					
	9 Deficiency The Technical Assessment Review (TAR) Task Teams are not using Technical Assessment Review Comment Records to document review team comments. Conclusions and recommendations were complete or being developed by the Task					
	10 Recommended Action(s): <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Investigative <input checked="" type="checkbox"/> Corrective Provide a description of both the remedial and corrective actions to be taken to address the deficiency and prevent recurrence. In addition, provide a					
Completed by Org. QA Org.	11 QAE/Lead Auditor Date T.W. Noland 1/19/89		12 Branch Manager Date J. King 1/19/89		13 Project Quality Mgr. Date James B. Dwyer 1/21/89	
	14 Remedial/Investigative Actions(s) 1. The TAR plan for the subject activity will be revised to require compliance with Rev. 0 of QMP 02-08 with respect to the use of TAR Comment Records. 15 Effective Date 2/3/89 2. The process described in Rev. 0 of QMP 02-08 regarding use of TAR Comment Records, resolution of comments and disputes will be implemented prior to (cont'd)					
	16 Cause of the Condition & Corrective Action to Prevent Recurrence Cause: During preparation of the TAR Plan, it appeared as though the process described by Rev. 0 of QMP 02-08 would not be suitable for this particular review because no interaction with the authors of the documents subject to review was expected to occur. The TAR Plan was revised to indicate that an adjustment to QMP 02-08 would be required to account for this intent and to provide instructions that were suitable to the circumstances. (Cont'd) 17 Effective Date 2/10/89					
	18 Signature/Date J. King 2/1/89 R. Levich 2/3/89					
Comp. by Org. QA Org.	19 Response <input checked="" type="checkbox"/> Accept <input type="checkbox"/> Amended <input type="checkbox"/> Reject Response		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89	
	20 Amended Response <input type="checkbox"/> Accept <input type="checkbox"/> Reject		QAE/Lead Auditor/Date		Branch Manager/Date	
	21 Verification <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89	
	22 Remarks See Page 3 for Verification					
23 QA CLOSURE		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89		
		PQM/Date James B. Dwyer 2/3/89				

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**YMPO STANDARD DEFICIENCY REPORT
CONTINUATION SHEET**

N-QA-038
12/88

SDR No. 283

Rev. 0

Page 2 of 2

8 Requirement (continued)

comment, this is documented on a Technical Assessment Review Comment Record." The Technical Assessment Review Plan for the Exploratory Shaft Facility (ESF) Title-I-Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations, Rev. 8, Para. 4.2 states in part, "In contrast, this TAR will not involve a comment-resolution process. Instead, the TAR will produce conclusions regarding the adequacy of the ESF Title I design and recommendations for actions to be taken to correct any significant deficiencies which are identified during the course of the review. To provide for this deviation from the process described in the current version of QMP-02-08, an Interim Change Notice will be developed and issued which modifies QMP-02-08 to provide the option of providing the type of product that is planned for this TAR. The Interim Change Notice must be in force before the TAR team begins to develop conclusions and recommendations but need not be in force before the TAR commences.

9 Deficiency (continued)

Teams and a Change Notice had not been issued to QMP-02-08 to provide for this deviation.

10 Recommended Actions (continued)

cause for the condition(s) noted and the effective dates when corrective action is to be completed.

14. (continued) the close of the TAR. Documentation (TAR Comment Records and related correspondence) of compliance with the provisions of QMP 02-08 will be included in the Review Record Memorandum.

16. (continued) During the TAR, however, it became apparent that the process described by QMP 02-08 could be used and this course of action was deemed preferable to revising the QMP.

Corrective Action: An Interim Change Notice (ICN) will be prepared requiring a QA review of the TAR plan prior to the conduct of a TAR. One purpose of such a review will be to assure that the TAR Plan and/or TAR Notice, as the case may be, does not contradict the instructions of QMP 02-08. The ICN will be prepared and presented for Project Office review and comment by the week ending 2/10/89.

YMPO STANDARD DEFICIENCY REPORT

N-QA-038
12/88

Completed by Originating QA Organization	1 Date 1/13/89		2 Severity Level <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3		Page 1 of 2
	3 Discovered During YMP-SR-89-004		3a Identified By K. Sommer T. Noland		3b Branch Chief Concurrence Date
	5 Organization Project Office		6 Persons(s) Contacted J. King, R. Levich, J. Jardine		4 SDR No. 284 Rev. 0
	7 Response Due Date is 20 Working Days from Date of Transmittal				
Completed by Organization in Block 5	8 Requirement (Audit Checklist Reference, if Applicable) NNWSI/88-9, Rev. 2, Section I, Para. 2.0, states in part, "The QA functions are those of assuring that an appropriate QA program is established and executed effectively and of verifying, such as by checking, auditing,				
	9 Deficiency The Technical Assessment Review Plan for the "Exploratory Shaft Facility (ESF) Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations," does not define the responsibilities and				
	10 Recommended Action(s): <input checked="" type="checkbox"/> Remedial <input type="checkbox"/> Investigative <input checked="" type="checkbox"/> Corrective Provide a description of both the remedial and corrective actions to be taken to address the deficiency and prevent recurrence. In addition, provide a				
	11 QAE/Lead Auditor Date T.W. Noland 1/19/89				
Comp. by Org. QA Org.	12 Branch Manager Date J. King 1/19/89		13 Project Quality Mgr. Date James Blaylock 1/27/89		
	14 Remedial/Investigative Actions(s) The TAR Plan will be revised to indicate the QA Specialist's responsibilities. A revision to the TAR plan to specify the role of the QA Specialist in the TAR will have no effect on the outcome of the TAR because the role of the QA Specialist is and was to act as a source of advice and counsel to the TAR Chairman regarding QA matters. The QA Specialist did not act as a reviewer.				
	15 Effective Date 2/3/89				
	16 Cause of the Condition & Corrective Action to Prevent Recurrence The failure to specify the role of the QA Specialist in the TAR process was an oversight in the preparation of plan. Corrective Action: An Interim Change Notice (ICN) will be prepared and issued for QMP 02-08 requiring a QA review of the TAR Notice and/or Plan prior to issuance. One aspect of this review will be to assure the role of QA is clearly indicated in the future TAR Notices and/or Plans.				
Comp. by Org. QA Org.	17 Effective Date 2/10/89				
	18 Signature/Date J. King 2/3/89 W. Levich 2/3/89				
	19 Response <input checked="" type="checkbox"/> Accept <input type="checkbox"/> Amended <input type="checkbox"/> Reject Response		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89
	20 Amended Response <input type="checkbox"/> Accept <input type="checkbox"/> Reject		QAE/Lead Auditor/Date		Branch Manager/Date
Comp. by Org. QA Org.	21 Verification <input checked="" type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89
	22 Remarks See page 3 for verification				
23 QA CLOSURE		QAE/Lead Auditor/Date T.W. Noland 2/7/89		Branch Manager/Date J. King 2/7/89	PQM/Date James Blaylock 2/5/89

ORIGINAL
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YMPO STANDARD DEFICIENCY REPORT
CONTINUATION SHEET

N-QA-038
12/88

SDR No. 284

Rev. 0

Page 2 of 2

8 Requirement (continued)

surveillance, and inspection, that activities that affect the quality functions have been performed correctly." Para. 4.0 of the same section states, "If more than one organization is involved in the execution of activities affecting quality, then the responsibility and authority of each organization shall be established and clearly documented."

9 Deficiency (continued)

authorities of the Quality Assurance organization in the Technical Assessment Review Process. Part of this problem is due to the fact that QMP-02-08 does not define the role of the QA organization in the TAR process.

10 Recommended Actions (continued)

cause for the condition(s) noted and the effective dates when corrective action is to be completed.

Noted During:

YMP-SR-89-003

Identified By:

K. Sommer/T. Noland

Date:

12/21/88

Organization:

YMP

Person(s) Contacted:

J. King/R. Levich

Response Due Date is
30 Days from Date of
Transmittal

Discussion:

The reading assignment training for the Team Members of the Technical Assessment Review concerning the Exploratory Shaft Facility (ESF) Title-I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations were completed on the "Special Training Assignment" form, #N-AD-077. This form is from draft procedure QMP-02-09 and therefore the form is not an approved form.

QA/Lead Auditor

Date

Branch Manager

Date

Wendell B. Murrell 12/23/88

Jerry Noland 12/28/88

Response:

A comparison of form N-AD-077 with form T-AD-056 (Figure 3 of QMP 02-01, Rev. 1), which was the only available alternative, indicates that the information required by both forms is the same with the exception that form T-AD-056 presents a broader selection of documents that may be deemed appropriate for reading assignments. The selection of documents given by T-AD-056 was not appropriate for this particular activity (TAR) as the TAR was focused on documents that are not listed on form T-AD-056.

Because the information provided on form N-AD-077 is accurate and is the same information required by form T-AD-056 there has been no effect on quality. Compliance with QMP-02-01 in this matter will be accomplished by preparing form T-AD-056 for each TAR team member, referencing the appropriate form N-AD-077, and attaching form N-AD-077 to form T-AD-056. Both forms will become a part of the Review Record Memorandum. This will be completed by 1/16/89. krl.

Signature:

[Signature] *[Signature]* *[Signature]* Date: January 28, 1989

Response Receipt Verified/Closed ☒

QA/Lead Auditor

Date

Branch Manager

Date

T.D. Murrell

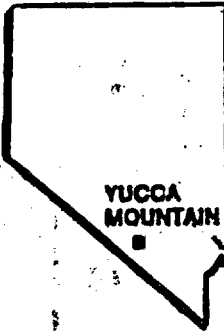
2/1/89

Mike H. Epp 2/2/89

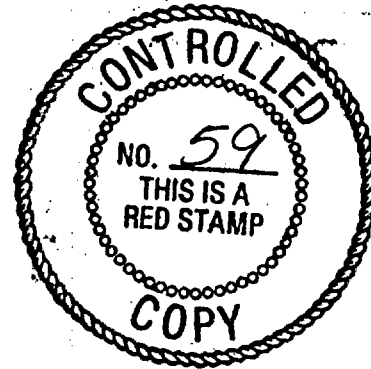
Remarks: Verification

The following five Technical Assessment Review Team members were selected to verify that the above corrective action had been completed: Felton Bingham, Ernest Hardin, Keith Kersch, Richard Lee, and Mike Lugo. Each of the above team members was found to have a completed T-AD-056 form which was signed by Jerry King and dated 1/24/89. The N-AD-077 forms in each case were attached to the T-AD-056 forms.

U.S. DEPARTMENT OF ENERGY

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M**

YUCCA MOUNTAIN PROJECT

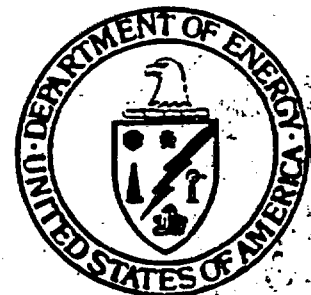


REVIEW RECORD MEMORANDUM

EXPLORATORY SHAFT FACILITY (ESF) TITLE I DESIGN ACCEPTABILITY ANALYSIS AND COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS

VOLUME *27* *Continued*

FEBRUARY 3, 1989



UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE/YUCCA MOUNTAIN PROJECT OFFICE

APPENDIX D

Meeting Minutes

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 12/12/88
Las Vegas, Nevada, 8:30 AM

Members of the Technical Assessment Review (TAR) team met for an introductory meeting on the Exploratory Shaft Facility (ESF) Title I design acceptability analysis and comparative evaluation of alternative ESF locations. A list of individuals attending the meeting is contained in Attachment 1.

The TAR Chairman, J. King, gave introductory remarks on the purpose of the TAR, gave a description of the Review Record Memorandum, TAR member qualifications, and distributed the draft TAR Plan and the Quality Management Procedure to be used for the review, QMP-02-08. Reading assignments were given to all team members to read QMP-02-08 by 12/13/88. It was noted that there will be an Interim Change Notice (ICN) implemented to permit one departure from QMP-02-08; the TAR will not involve a comment resolution process; the TAR will develop conclusions and recommendations for corrective actions, if needed, for management consideration.

Subcommittee group leaders were selected by the Chairman: S. Sinnock on alternative locations; A. Matthusen on data reasonableness; and M. Voegele and J. Tillerson on design requirements and criteria.

The TAR Package was introduced; the current status of that material is contained in Attachment 2.

The Chairman asked for review comments on the draft TAR Plan. Questions were raised on the number of documents to be reviewed. It was agreed that the TAR Package represented material to be assessed as part of ESF design evaluation, and that other materials, such as the 10CFR60 regulatory flowdown analysis being prepared by DOE/HQ and section 8.4 of the SCP, are available as resource materials which the TAR team can use (rely on) to help assess design acceptability. The TAR team is not precluded from commenting on or identifying deficiencies in resource materials, but that is not part of the teams' charter. The question of disqualification of members who wrote portions of SCP section 8.4 was raised. It was decided that only primary authors of ESF Title I Design should be excluded from this review. Also disqualified from the team were individuals who were principal authors of the SDRD. It was agreed that SCP section 8.4 would be useful for the review. The structure of 8.4 was described as comprising four basic components: (1) technical analysis; (2) technical conclusions; (3) compliance with criteria; and (4) agreement with 10CFR60. The emphasis of the review would be expanding the relationship between items (3) and (4).

There was additional discussion on the selection of the review team. It was agreed that documentation should demonstrate how the review team was selected. It was agreed that a geochemist should participate in the review. It was also agreed that a case could be made that the team, as a group, has at least as much expertise and qualifications for the requirements of the task than the individuals that did the work.

Minutes compiled by R.C. Lee: *R.C. Lee*

Date: *1/6/89*

Concurrence by:

James Z. King

Date: *1/6/89*

ATTACHMENT 2

Name

PHONE

Ernest H. Smith

SCOTT VAN CAMP

ROBERT A. LEVICH

KEITH M. KERSCH

William E. Wilson

WILLIAM E. GENTLE

W. ARCH GIRDLEY

FELTON W. BINGHAM

CHARLES YOSS

JOE TILLERSON

Jeff Kimball

SCOTT SINNOCK

AUGUST MATTHUSEN

Jerry King

CLIFF NORONHA

Keith Schwartztrauber

Michael Voegelé

WESTON/WBEC

DOE/YMP

SAIC

USGS

USGS

DOE/YMP

SNL

PNL

SNL

DOE/HQ

SNL/LV

SAIC

SAIC

Weston/REGU

SAIC/QA

SAIC

(202) 646-6768

702-794-7638

Attachment 2

Initial TAR Package

1. Generic Requirements Document/Appendix E
Status: (8) copies
2. ESF-SDRD Vols I & II
Status: (8) copies (except Appendix D)
3. RIB
Status: (8) copies of draft ver.4
(1) copy of ver.3
4. ESF Design Scope & Planning Doc for Title 1 design (& Basis for Design)
(Fenix & Scisson)
Status: (8) copies
5. ESF Title I Scope and Planning Basis Doc (Holmes & Narver)
Status: (8) copies
6. ESF Title I Design Basis Doc (Holmes & Narver)
Status: (8) copies
7. Nuclear Waste Repository in Tuff Subsurface Facility Conceptual Design
ESF/Repository Interface Control Drawing Number R07048A, sheets 1-15,
(prepared by SNL)
Status: (8) copies

Resource Documents

1. Draft 10CFR60 Flowdown Rept (prepared by HQ)
Status: (8) copies
2. Applicable parts of SCP
Status: (15) copies of sec 8.4 (ver 12/88)
(1) copy of scp (ver 12/88)

Procedures

10. QMP-02-08
Status: (15) copies

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 12/13/88
Las Vegas, Nevada, 8:30 AM

A meeting attendance list is contained in Attachment 1. All team members signed form N-AD-077 indicating that they had read QMP-02-08.

The official TAR Plan (inadvertently labeled as Rev. 8 instead of Rev. 0) was distributed to all team members and J. King explained the changes that had been made from the draft plan distributed on 12/12/88.

All committee members were asked to indicate any work schedule difficulties between 12/14 and 12/22. This schedule is contained in Attachment 2.

The subcommittee team leaders gave presentations on their ideas for addressing the TAR tasks to be accomplished (the subcommittee team list is contained in Attachment 6).

A. Matthusen discussed the data used in SCP Section 8.4. He introduced a table (submitted by SNL) of ESF design features, their relationship to the analyses performed, and a correspondence to the physical parameters used. It was suggested that these parameters could be compared to values in the RIB. The Title II Design task force looking at the RIB can be contacted to give a list of any data that they consider to be unreasonable. A general consensus was that the committee was to assess whether or not the data were reasonable, the models were reasonable, and were the use of the results of the calculations appropriate for design and evaluation. Additional considerations are: (1) the sensitivities of the design features to the range of parameter uncertainties; (2) evaluation of the overall adequacy of conceptual models. It was decided that a detailed sensitivity analysis for the calculations was not in the current scope.

The question was raised on whether to evaluate every analysis reported for Title I design. It was suggested that we examine SCP Section 8.4.3.3 for the calculations that were used. In addition, the data could be compared to values given in the RIB, where data could be found. J. Tillerson commented that the design process consists of design requirements, design, and analysis of design. Also, the analyses of Title I design were performed by various project participants and were summarized in the SCP Sec. 8.4. Rather than summarizing the analysis again, and including that summary in the Title I design report, the Project should incorporate the analysis in the Title I design report by reference to Sec. 8.4.

It was decided that the subcommittee would develop flow charts on evaluation of data and model reasonableness and present these to the Chairman on 12/14/88.

J. Tillerson presented a general discussion on Design requirements/Criteria. This discussion outlined the NRC concerns for this review, and how the committee might progress from 10CFR60 requirements to design criteria. The viewgraphs are contained in Attachment 3.

M. Voegele continued the discussion on Design Requirements/Criteria by noting that there were 157 requirements in 10CFR60, and according to the Lahoti flowdown analysis document, 46 are applicable to ESF. Attachment 4 contains a breakdown of the three NRC concerns for the 46 requirements applicable to the ESF (done by C. Pflum and M. Davenport). For the 46 10CFR60 requirements, and for each NRC concern, are the tabulated interfaces to the repository, testing, performance assessment, and "other". The breakdown also includes the physical element of the ESF breakdown structure. It was suggested that for development of criteria, Performance Assessment could be taken from the SCP together with the NRC concerns, the interfaces, and the physical system description. The criteria developed by this group could be used as input to Title II.

M. Voegele also listed what he believed to be the primary NRC concerns for ESF design: (1) Controlled Blasting; (2) water/fluid control; (3) shaft location (associated flooding/erosion); (4) underground layout (drift to south); (5) construction/operation (impact on testing); (6) seismic criteria (QA level I?); (7) thermal effects; (8) representativeness; (9) visitors; (10) shaft separation; (11) shaft diameter; (12) creation of groundwater pathways; and (13) test preparations.

There was a discussion about whether the NRC concerns might be unrelated to requirements. If so, could the Project make other arguments to satisfy their concerns, such as "cost-benefit" arguments?

S. Sinnock gave a presentation on alternative shaft locations. His discussion (see Attachment 5) began with three primary categories which could be used to objectively evaluate site selection: (1) Performance objectives; (2) Processes of Concern; and (3) Property Categories from "upper- to lower-surrogates". The idea is to compare the site characteristics, by starting with the lowest surrogate (most basic site characteristic), and comparing the likelihood that these items would influence the direction of site selection. Sinnock indicated that sites to the east would be expected to have the worst performance (because of increased hydraulic flux at sites to the east, and because the eastern sites have an expected decreased GWT), however, the ESF characterizations for the eastern sites could be justified on the basis that we are characterizing the "worst-case". It was noted that the committee must address both the relative and absolute comparisons to performance.

Minutes compiled by R.C. Lee: *Rick C. Lee*

Date: *1/6/89*

Concurrence by: *Henry Z. King*

Date: *1/6/89*

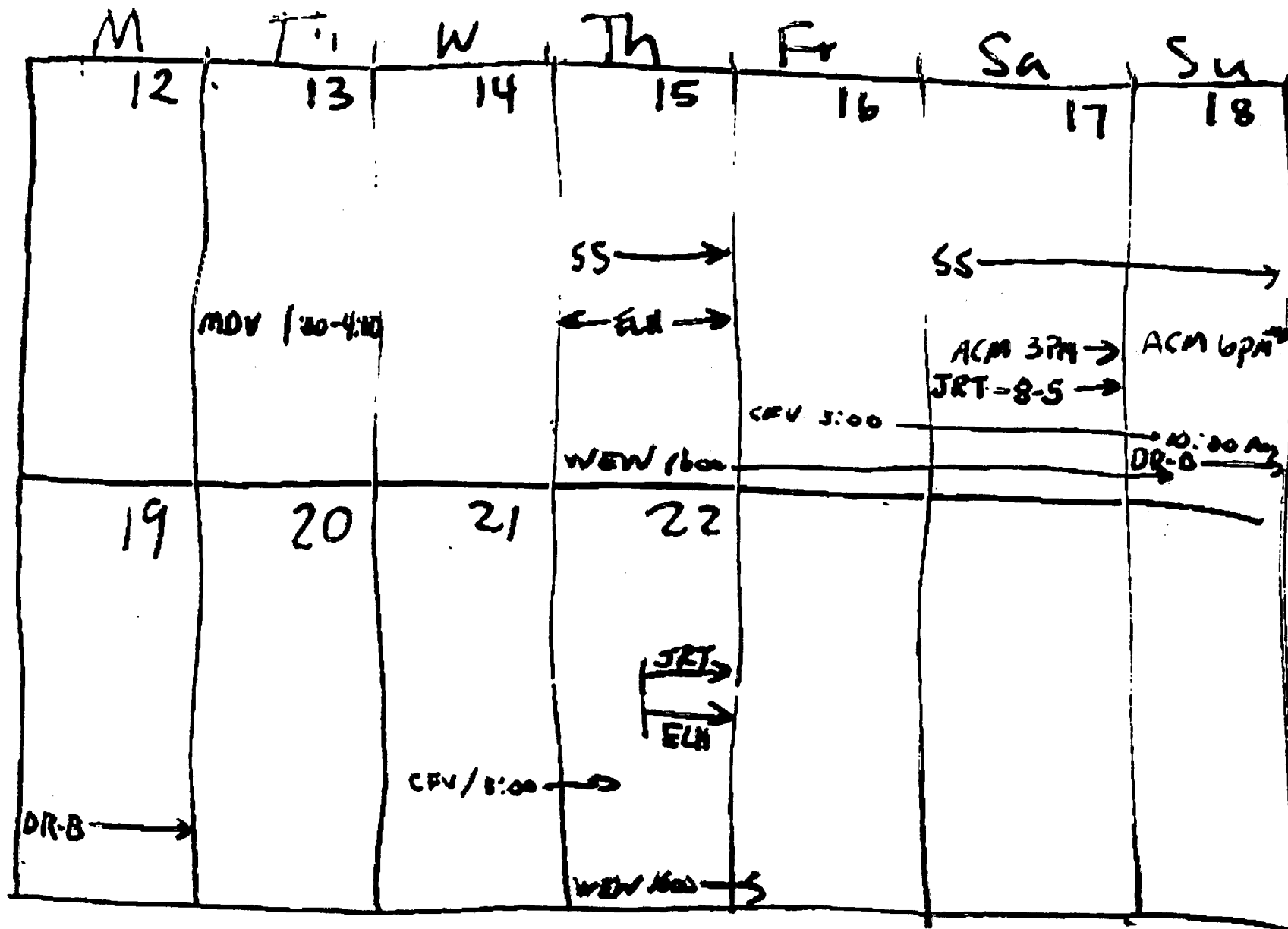
Attachment 1

TAR Meeting Minutes 12/13/88

Name

Organization

RICHARD LEE	SAIC	202-794-7134
KEITH KERSCH	SAIC	(FTS) 544-7620
William E. Wilson	USGS	" 776-4920
CRAIG B. BENTLEY	USGS	" 776-0519
Mike Lugo	Weston/Jacobs	(202) 646-6756
Bernard Ross-Brown	SAIC	(614) 451-0515
AUGUST MATTHUSEN	SAIC	FTS 544-7625
SCOTT VAN CAMP	WESTON/WDEC	202/646-6640
W. ARCH GIRDLEY	DOE/YMPO	794-7584
CHARLES VOSE	PNL / HQ	202 646 5206
JOE TILLERSON	SNL	844-5575
SCOTT SINNICK	SNL/LV	202 794-7200
Michael Beyle	SMC	702-794-7638
Jerry King	SAIC	702-794-7648



NRC WANTS :

10 CFR 60 Relationship to Specific
Design Criteria for ESF

Interfaces Defined

Assurance that Design Considers Their Principal
Concerns :

1. Ability to Isolate Waste
2. Good Quality Site Data
3. Representativeness

Attachment 3

PROCESS: 10CFR60 → CRITERIA

10CFR60



ESF Applicable
Portions



NRC Concerns
(A, B, C)



Interfaces
(Test, Repository, PA, Others)



Key ESF Elements
(1st shift, test areas, etc.)



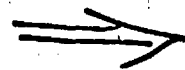
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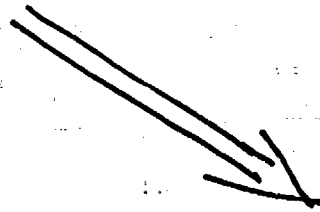
10CFR60

CRITERIA



Is SDRD for Title I
Complete ("Adequate")?

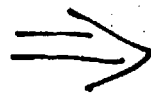
2.4.2



Is TITLE I DESIGN
ADEQUATE?

2.4.3

Analyses Used in
Design & Design
Analyses



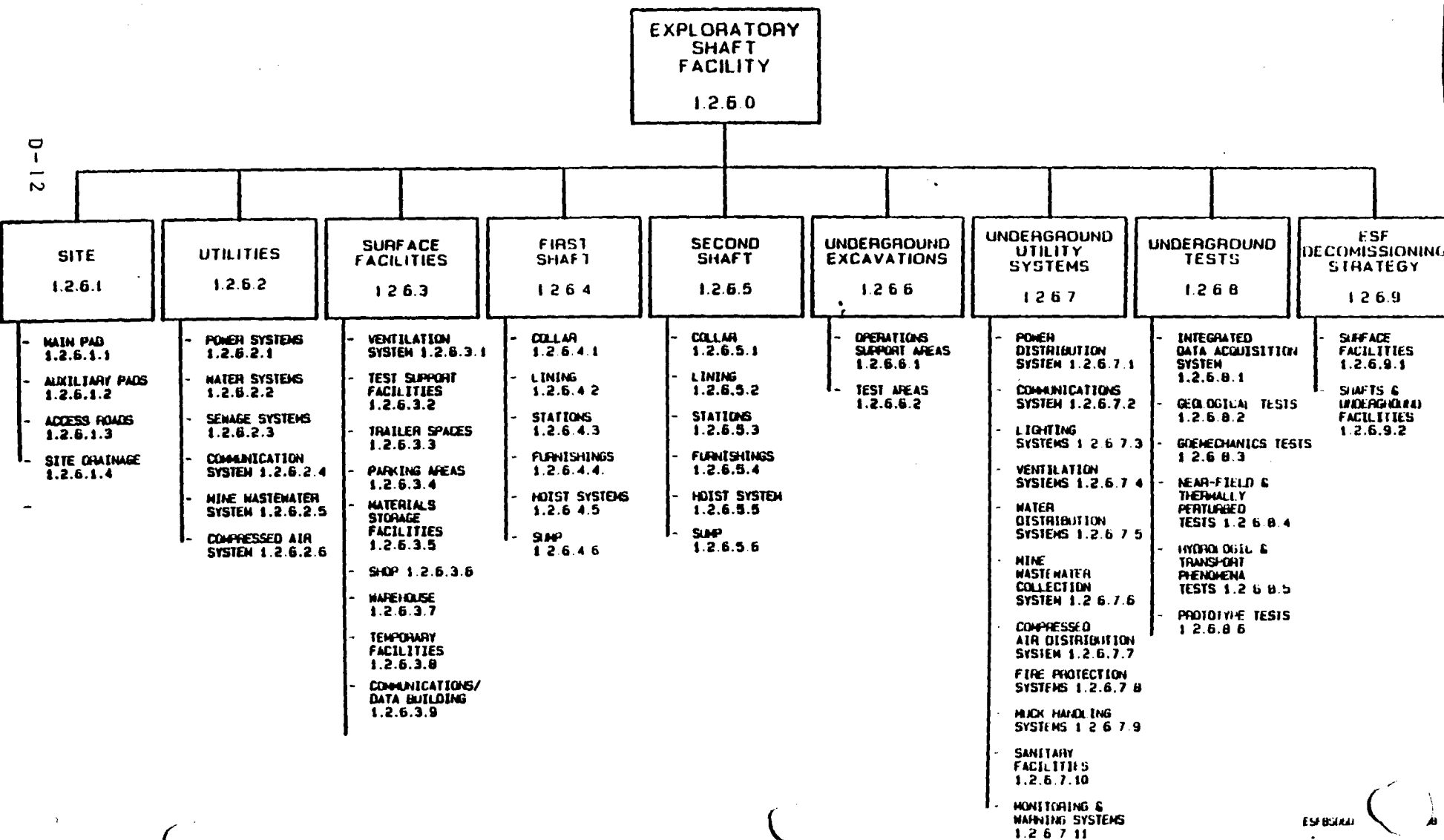
Was DATA USED
in TITLE I DESIGN
APPROPRIATE?

2.4.4

Attachment 4

ESF BREAKDOWN STRUCTURE

D-12



EXPLORATORY SHAFT FACILITY
SUBSYSTEM DESIGN REQUIREMENTS DOCUMENT
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APPENDICES

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Appendix B	Test and IDS requirements and test data sheets	Vol. 2
Appendix C	ESF drilling requirements	Vol. 2
Appendix D	Reference Project documentation	Vol. 2
Appendix E	Applicable regulations, codes, and specifications	Vol. 2
Appendix F	Work order system / Work Breakdown Structure	Vol. 2
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A. characterization does not com
ability of site to isolate waste

MDV 124

1/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS

APPLICABLE
10 CFR 60
REQUIREMENTS

60.15(b) ..site characterization to include in situ exploration &
testing at depths of waste emplacement

- 60.15(d)(1) limit impacts
(2) limit no. boreholes
(3) boreholes / shafts in pillars
(4)

60.16
60.21(c)(1)(ii)(A) comp. eval. major features
60.21(c)(1)(ii)(B) design features closure
60.21(c)(ii)

60.72(a)
60.72(b)
60.74 NRC defined tests

60.111(a)
60.111(b)(1) ..preserve the option of waste retrieval throughout ...
60.111(b)(3)

60.112 total system performance
60.113(a)(1)(i) sub. complete + gradual release
60.113(a)(1)(ii)(A) 300-1000 yr waste package
(B) 1 part in 10⁻⁵ release rate
60.130 other features to meet perf obj

NRC
1

Repository
Testing
Emplacement
Other

FACILITY
SHE
UTIL
SURF F.
FIRST SH
SND SH
UG EXC
UG VHL
UG TST
DECOM

2/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

APPLICABLE CFR 60 REQUIREMENTS	NRC 1	Repository	Testing	P Asses - Site	Other	FACILITY	SITE	UTIL	Surf F.	First SH	Secd SH	UG EXC	UG Util	UG test	DECOM
60.131(b)(1)...structures, systems components important to safety .. designed natural phenomena and environmental conditions anticipated ...will not interfere with necessary safety functions....															
60.131(b)(2)															
60.131(b)(3)															
60.131(b)(4)(i)															
60.131(b)(6)															
60.131(b)(9)															
60.133(a)(1) ① Orientation, etc	X	•										•			
(2) disruptive events	X	•				•									
60.133(b) ① Underground facility to be designed with sufficient flexibility to allow adjustments...to accomodate specific site conditions	X	•	•									•			
60.133(c)															
60.133(d) control water + gas	X	•				•									
60.133(e)(1)															
(2) ④ deleterious movement subsidence	X	•					•			•	•	•			
60.133(f) ③ excavation - control blasting	X	•					•			•	•	•			
60.133(g)															
60.133(h) ④ assist ebs water control, chem chs	X	•					•			•	•	•			
60.133(i) ④ thermal loads - fuel cell	X	•								•	•	•			
60.137 performance confirmation	X	•	•			•									
60.140(b)															
60.140(c)															

RC Meeting
88
p Material
3

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

CABLE
R 60
REMENTS

60.140(d)(1)..program does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives.....

60.141(a)
60.141(b)
60.141(c)
60.141(d)
60.141(e)
60.142(a)
60.142(b)
60.142(c)
60.142(d)

60.151 QA program applicability
60.152 QA pgm. basis

NR
1

Repository
Testing

P. Assels - Site

Other

FACILITY
SNE
UTIL
SURF F.
FIRST SH
SND SH
UG EXC
UG UTIL
UG TST
DECOMM

3/12

B - testing program does not com
ability to characterize site

4/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS

APPLICABLE 10 CFR 60 REQUIREMENTS	NRC CON 2	Repository Testing Passes + Site Other				FACILITY	SITE	UTIL	SURF F.	FIRST SH	SND SH	UG EXC	UG VHL	UG TST	DECOM
60.15(b) ..site characterization to include in situ exploration & testing at depths of waste emplacement															
60.15(d)(1) <u>limit impacts</u>															
(2) <u>limit no. bore holes</u>															
(3) <u>boreholes / shafts in pillars</u>															
(4)															
60.16															
60.21(c)(1)(iii)(A) <u>Comp. eval. major features</u>															
60.21(c)(1)(iii)(B) <u>design features closure</u>															
60.72(a)															
60.72(b)															
60.74 <u>NRC defined tests</u>	X														
60.111(a)															
60.111(b)(1) ..preserve the option of waste retrieval throughout ...															
60.111(b)(3)															
60.112 <u>Total system performance</u>															
60.113(a)(1)(i) <u>sub. complete + gradual release</u>															
60.113(a)(1)(ii)(A) <u>300-1000 yr waste package</u>															
(B) <u>1 part in 10⁻⁵ release rate</u>															
60.113 <u>Other features to meet perf obj</u>															

5/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

LICABLE CFR 60 UIREMENTS	NRC CONC		Repository Testing	Passage to Site	Other	FACILITY	SITE	UTIL	SURF F.	Fst SH	Snd SH	UG EXC	UG Uhl	UG tst	DECOM
		2													
60.131(b)(1)...structures, systems components important to safety .. designed natural phenomena and environmental conditions anticipated ...will not interfere with necessary safety functions....															
60.131(b)(2)															
60.131(b)(3)															
60.131(b)(4)(i)															
60.131(b)(6)															
60.131(b)(9)															
60.133(a)(1) <i>orientation, etc</i>															
(2) <i>disruptive events</i>		X													
60.133(b)...underground facility to be designed with sufficient flexibility to allow adjustments...to accomodate specific site conditions		X													
60.133(c)															
60.133(d) <i>control water + gas</i>		X													
60.133(e)(1)															
(2) <i>deteriorous movement</i>		X													
60.133(f) <i>excavation</i>		X													
60.133(g)															
60.133(h) <i>assist ebs</i>															
60.133(i) <i>thermal loads</i>															
60.137 <i>performance confirmation</i>															
60.140(b)															
60.140(c)															

-NRC Meeting
8-88
kup Material
e 3

6/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

APPLICABLE
CFR 60
REQUIREMENTS

NRC CON
2

Repository
Testing

Passless + Site

Other

FACILITY
SITE
UTIL
SURF F.
FIST SH
SND SH
UG EXC
UG UTIL
UG TST
DECOMM

60.140(d)(1)..program does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives.....

60.141(a)
60.141(b)
60.141(c)
60.141(d)
60.141(e)
60.142(a)
60.142(b)
60.142(c)
60.142(d)

60.151 - QA Program Applicability
60.152 - QA Program Basis

X
X

CERN
1 3

Repository
Testing
P. Assets + Site
Other

D-22

Repository	Testing	Assets	Site	Other

D-23

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

CERN
3

QA Program Applicability
QA Program Basis

Repository
Testing
Assessment
Other

FACILITY	SNE	UTIL	SURF F.	FIRST SH	2ND SH	UG EXC	UG UTIL	UG 1ST	DECOMB
----------	-----	------	---------	----------	--------	--------	---------	--------	--------

9/12

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS

10/12

APPLICABLE
10 CFR 60
REQUIREMENTS

60.15(b) ..site characterization to include in situ exploration & testing at depths of waste emplacement

- 60.15(d)(1) limit impacts
(2) limit no. bore holes
(3) boreholes / shafts in pillars
(4) coord drilling with GROA

60.16 SCP + comments on shaft

60.21(c)(1)(ii)(d) comp. eval. major features

60.21(c)(1)(ii)(e) ident items imp. to safety

60.21(c)(11) design features closure

60.72(a) maintain const records rec. clv elsewhere

60.72(b) contents of records

60.74 NRC defined tests

60.111(a) 10 CFR 20 complia

60.111(b)(1) ..preserve the option of waste retrieval throughout

60.111(b)(3) retrieval schedule ventil not report sched n fail

60.112 total system performance

60.113(a)(1)(i) sub. complete + gradual release

60.113(a)(1)(ii)(A) 300-1000 yr waste package

(B) 1 part in 10⁻⁵ release rate

60.130 other features to meet perf obj

	D	Repository	Testing	Assessment	Other	Facility	Site	Util	Surf F.	First SH	Second SH	UG Exc	UG Util	UG Test	Decom
60.15(b) ..site characterization to include in situ exploration & testing at depths of waste emplacement															
60.15(d)(1) <u>limit impacts</u>															
(2) <u>limit no. bore holes</u>															
(3) <u>boreholes / shafts in pillars</u>															
(4) <u>coord drilling with GROA</u>	X	•												•	
60.16 <u>SCP + comments on shaft</u>	X					•									
60.21(c)(1)(ii)(d) <u>comp. eval. major features</u>	X	•				•									
60.21(c)(1)(ii)(e) <u>ident items imp. to safety</u>	X	•				•									
60.21(c)(11) <u>design features closure</u>	X					•									
60.72(a) <u>maintain const records</u> <u>rec. clv elsewhere</u>	X					•									
60.72(b) <u>contents of records</u>	X					•									
60.74 <u>NRC defined tests</u>	X					•									
60.111(a) <u>10 CFR 20 complia</u>	X	•				•									
60.111(b)(1) ..preserve the option of waste retrieval throughout	X	•				•				•	•	•			
60.111(b)(3) <u>retrieval schedule</u> <u>ventil not report sched n fail</u>	X	•				•				•	•	•			
60.112 <u>total system performance</u>															
60.113(a)(1)(i) <u>sub. complete + gradual release</u>															
60.113(a)(1)(ii)(A) <u>300-1000 yr waste package</u>															
(B) <u>1 part in 10⁻⁵ release rate</u>															
60.130 <u>other features to meet perf obj</u>															

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

REQUIREMENTS

60.131(b)(1)...structures, systems components important to safety ..
designed natural phenomena and environmental conditions
anticipated ...will not interfere with necessary safety
functions....

60.131(b)(2) prot. dynamic failure

60.131(b)(3) prot. fire and explosion

60.131(b)(4)(i) SS+C maintain control

60.131(b)(6) inspection, testing, maintenance

60.131(b)(9) comp. mining regulations

60.133(a)(1) orientation, etc

(2) *disruptive events*

60.133(b)...underground facility to be designed with sufficient flexibility to allow adjustments...to accomodate specific site conditions

60.133(c) retrieval of waste

60.133(d) control water + gas

60.133(e)(1) retratability

(2) deteriorous movement

60.133(F) excavation

60.133(g) - ventilation

60.133(h) assist ebs

60.133(i) thermal loads

60.137 performance, confirmation

50.140(b) start p.c. during site char

50.140(c) - appropriate monitoring program

Repository

Testina

24555-5100

2010

Facility

3115

UTIL

52144.

HS 1513

HIS PWS

06 Ex

116 1161

44 311

1250

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

**APPLICABLE
CFR 60
REQUIREMENTS**

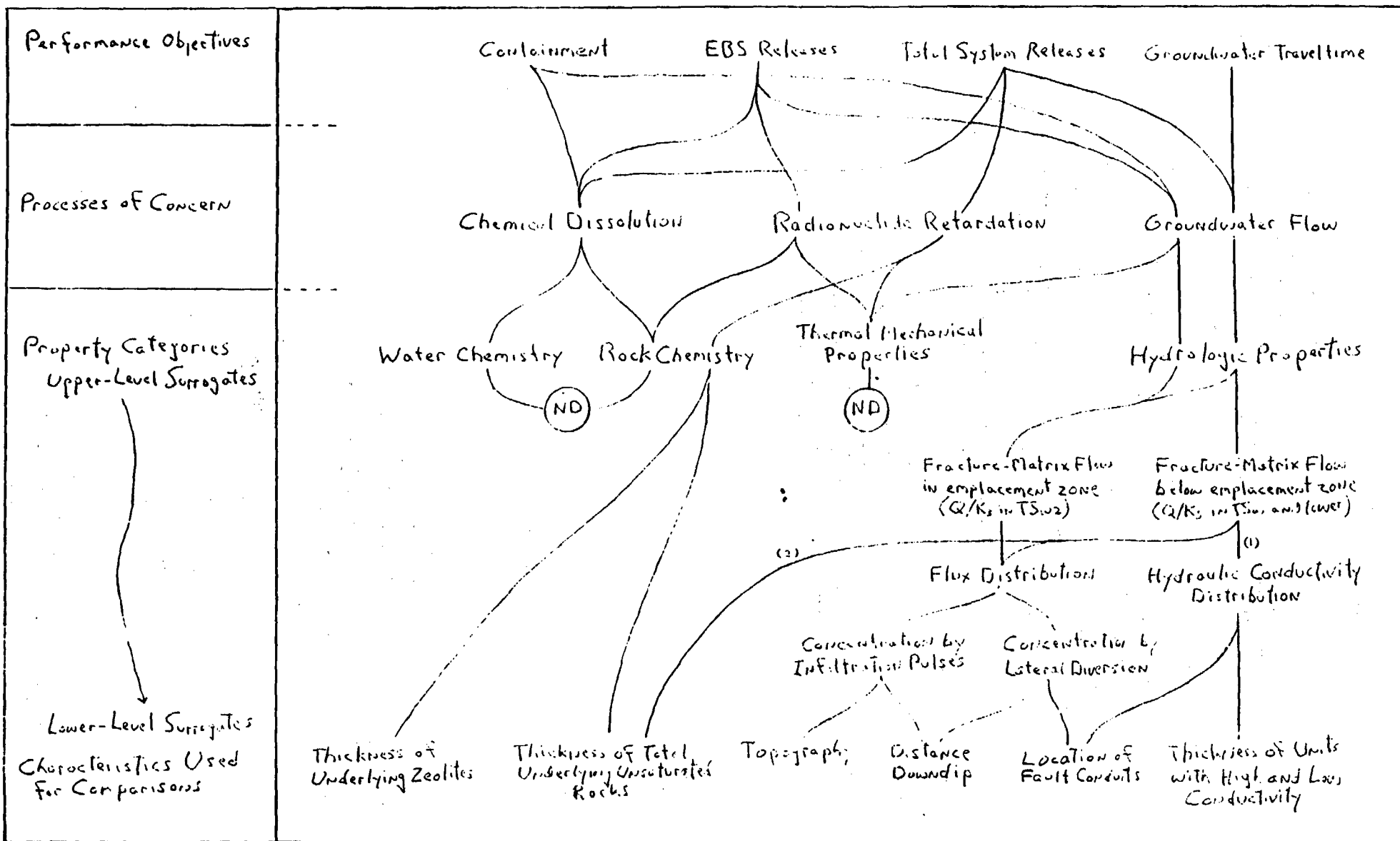
5 60.140(d)(1)..program does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives.....

- 6 60.141(a) surveillance, mapping, history
- 7 60.141(b) monitor design
- 8 60.141(c) minimum required measurements
- 9 60.141(d) compare to original design
- 0 60.141(e) monitor thermal-mechanical
- 1 60.142(a) borehole / shaft seals
- 2 60.142(b) initiated early
- 3 60.142(c) test backfill effectiveness
- 4 60.142(d) seal effectiveness
- 5 60.151 QA Program Applicability
- 6 60.152 QA Program Basis

Repository	Testine	P. Asses +	Other

12/12

[illegible]

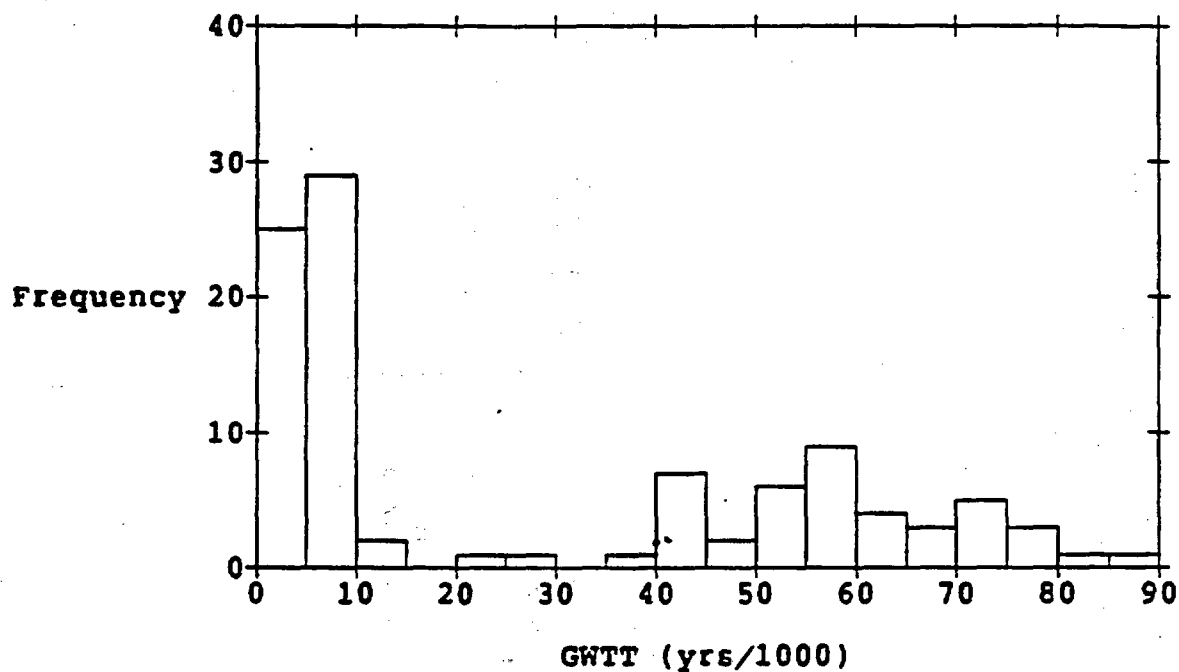


(1) Q/K_f in low K_{u2}
(2) Q/K_f in low K_{u1}

Figure 2. Schematic Representation of Relations Among Performance Objectives and a Hierarchy of Reasonable Surrogate Site Characteristics For Comparing Performance Potential at Alternative Locations; ND = nondiscriminating

Figure 3

HISTOGRAM
ES1 - 0.5 MM/YR FLUX
100 SIMULATIONS



HISTOGRAM
ES1 - 0.5 MM/YR FLUX
100 SIMULATIONS

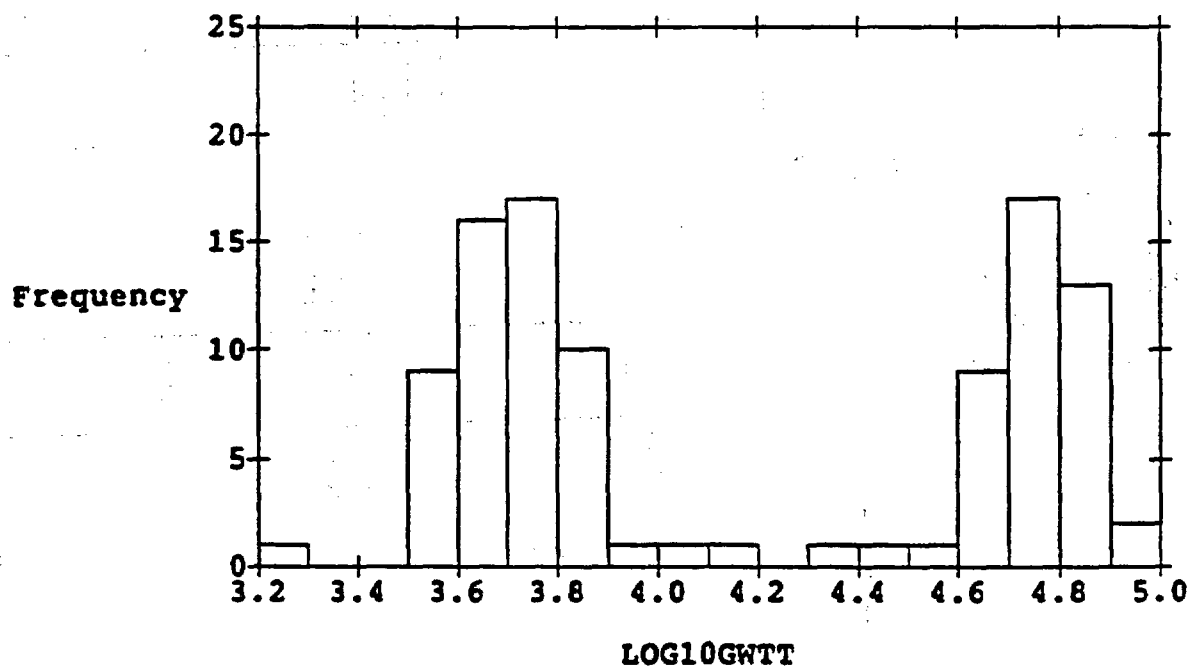


Figure 4

FIGURE 1.

Stratigraphy At ES Locations

From Base of Repository to Water Table

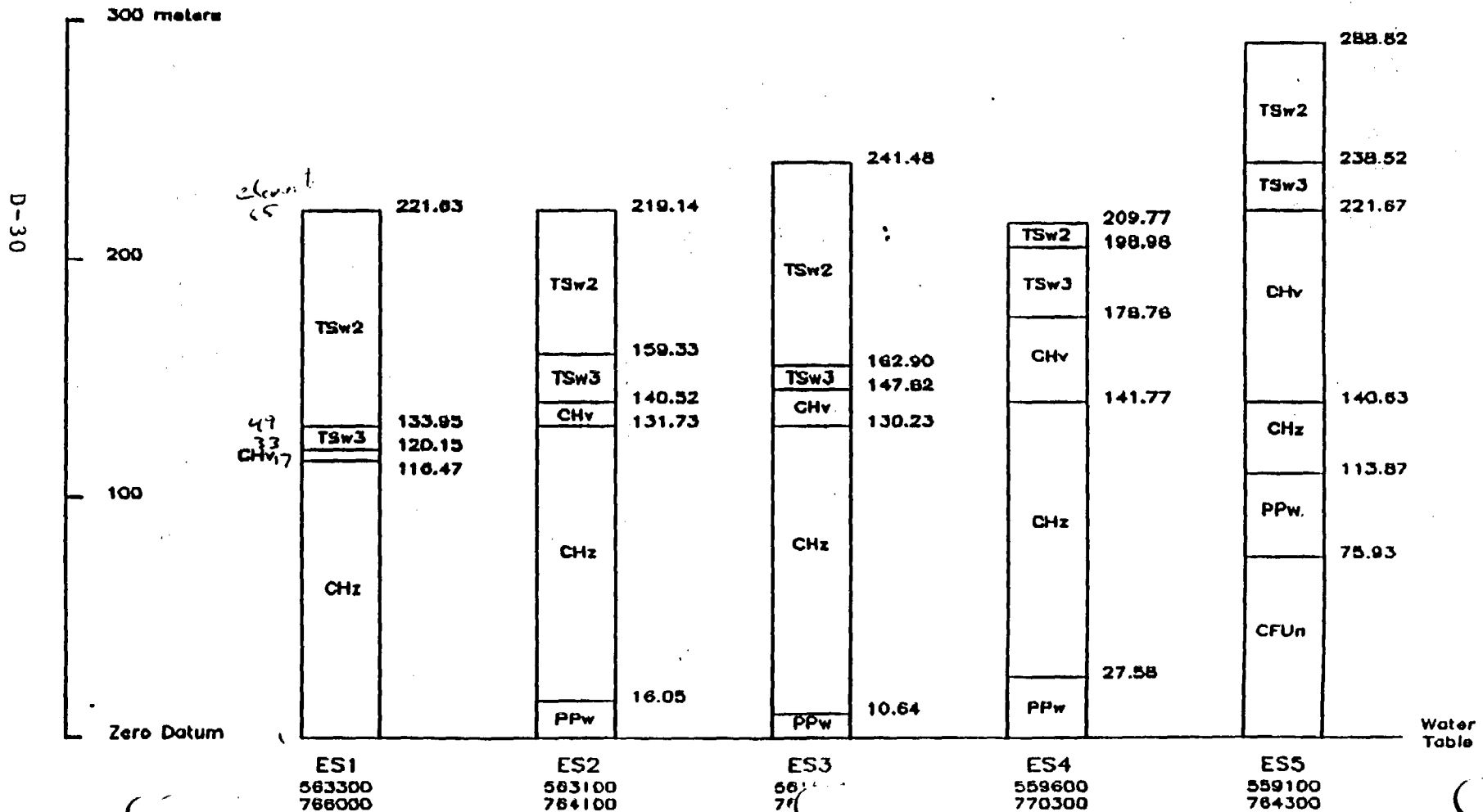


Table ~~8.3.5.13-3~~¹. Categories of scenarios delineated according to potential impacts on barriers of the geologic repository (scenario classes)

Disturbed performance of barriers.

(A) Direct Releases:

- 1) direct release in an extrusive magmatic event;
- 2) direct release associated with human intrusion

(B) Partial failure of engineered barriers^a

(C) Partial failure of unsaturated zone barriers:

- 1) accelerated releases to the water table attending increased flux from sources above the repository;
- 2) accelerated releases to the water table attending a rise in the water table (foreshortening of unsaturated zone);
- 3) accelerated releases to the water table attending changes in unsaturated zone rock-hydrologic properties or geochemical properties.

(D) Partial failure of saturated zone barriers:

- 1) accelerated releases to the accessible environment owing to appearance of discharge points within 5 km downgradient of controlled area (foreshortening of the saturated zone flow path), or changes in flow direction in saturated zone.
- 2) accelerated releases to the accessible environment owing to increased linear water velocity in the saturated zones, changed rock-hydrologic properties, or changed geochemical properties.

Undisturbed and nominal performance of all barriers.

- (E) Undisturbed performance of all natural barriers:
(matrix flow predominates in unsaturated zone barriers, some carbon-14 released in gas phase)

^aNo independent, potentially significant classes have been associated with this category.

	Containment (10 CFR 60.112)	EBS Releases (10 CFR 60.112)	Groundwater Travel Time (10 CFR 60.112)	Total System Releases (10 CFR 60.11)
<u>Nominal Undisturbed Performance</u>	LLS	LLS	LLS	LLS
Hydrologic Characteristics	LLS	LLS	LLS	LLS
Flux through Unsaturated Zone	LLS	LLS	LLS	LLS
Dip of Units	yes	yes	yes*	yes
Locations of Faults	yes	yes	yes*	yes
Surface Topography	yes	yes	yes*	yes
Saturated Hydraulic Conductivity	LLS	LLS	LLS	LLS
Thickness of Units	NO	NO	yes*	yes
Location of Faults	yes	yes	yes*	yes
Thickness of Underlying UZ	NA	NA	yes*	yes
Geochemical Characteristics	NO	NO	NA	LLS
Water Chemistry	NO	NO	NA	NO
Rock Chemistry	NO	NO	NA	LLS
Thickness of Underlying Zeolites	NO	NO	NA	yes
Thickness of Underlying UZ	NO	NO	NA	yes
Thermal-Mechanical Characteristics	NO	NO	LLS	NO
Distance to vitric units	NO	NO	II	NO
Distance to zeolitic units	NO	NO	II	NO
<u>Disturbed Scenario Categories</u>	LLS	LLS	NA	LLS
Direct Releases, Magnitude Event	IO	IO	NA	IO
Engineered Barrier Partial Failure	NSI	NSI	NA	NSI
Increased Flux Above Repository	LLS	LLS	NA	LLS
Dip of Repository	yes	yes	NA	yes
Surface Topography	yes	yes	NA	yes
Location of Faults	yes	yes	NA	yes
Water Table Rise	NA	NA	NA	LLS
Thickness of Underlying UZ	NA	NA	NA	yes
Property Changes in UZ	NO	NO	NA	NO
Appearance of New Directly Hs.	NA	NA	NA	NO
Property Changes in SZ	NA	NA	NA	NO
Direct Releases, Human Intrusion	NO	NO	NA	NO

* Groundwater Traveltime is to be calculated along "fastest path" independent of shaft location

LLS = lower level surrogate used for comparisons for this performance objective

yes = useful surrogate characteristic for comparisons (i.e. magnitude and discriminating)

NO = nondiscriminating characteristic for performance based on current data

NA = not applicable for this performance objective (i.e. unanticipated or no previous explanation)

II = insufficient information to about disturbed zone definition to use as discriminator

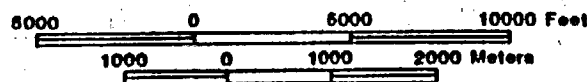
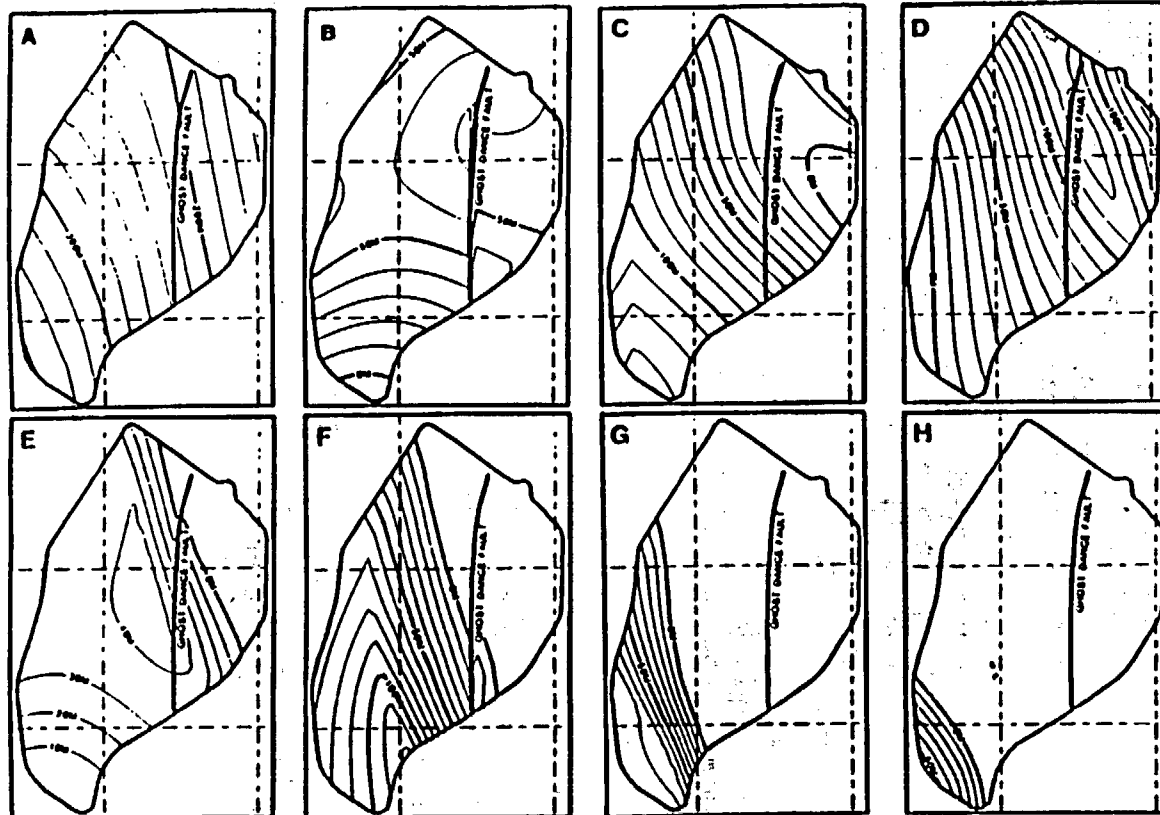
NSI = no scenario yet identified

UZ = Unsaturated Zone; SZ = Saturated Zone

IO = insufficient data to use as a discriminating factor

Table 2. Applicability of Surrogate Site Characteristics for Comparing Performance with Respect to NRC Performance Objectives

Note: These will be replaced with new maps showing thickness
 from repository in field and extending to area of lines on fault map



ISOPACH CONTOUR INTERVAL IS 10 METERS

SOURCE: GE/CALMA PRODUCT NOS. 0060, 0047-0053

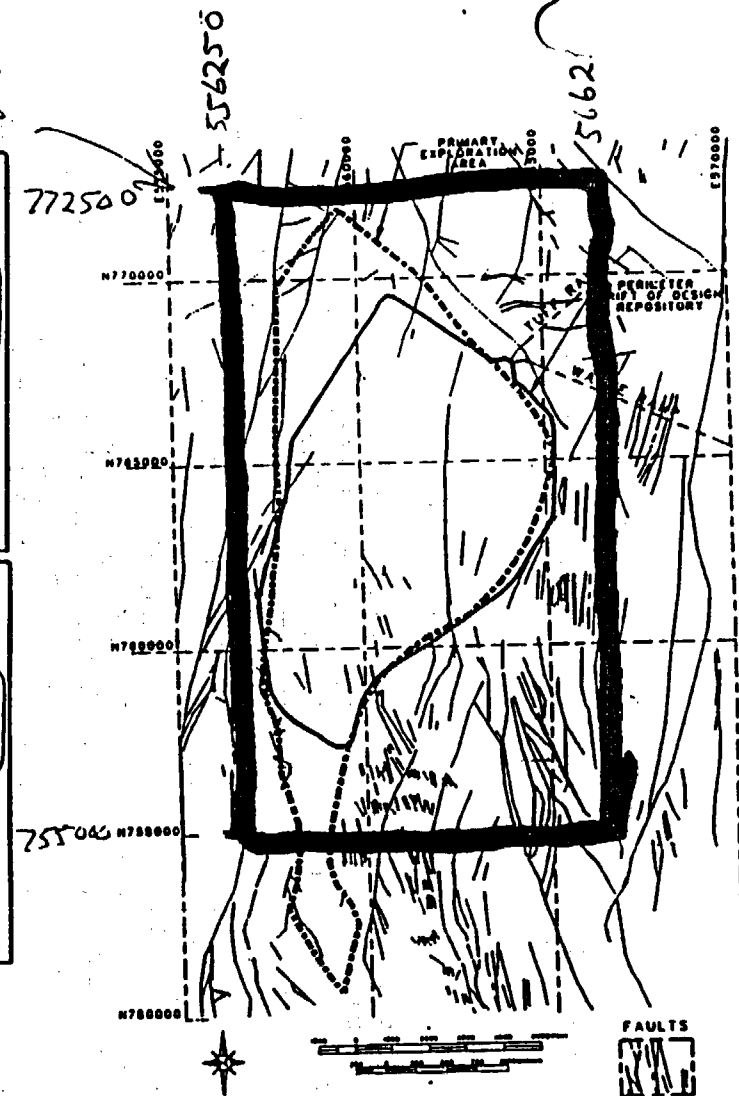


Figure 1. Isopach Maps of Hydrostratigraphic Units below the Repository and Location of Faults

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 12/19/88
Las Vegas, Nevada, 10:30 AM

A meeting attendance list is contained in Attachment 1.

Status reports were given by the subcommittee leaders, M Voegele, S. Sinnock, and A. Matthusen. Voegele reported that they were completing three products: (1) criteria for regulatory requirements, to be reviewed by Tom Hunters' group; (2) the SDRD will be reviewed for regulatory requirements (John Davenport to become part of the TAR review team?); and (3) lists of testing criteria used to test design. Sinnock raised the question of whether or not individuals performing backup work, such as the groundwater travel-time calculations being performed by Sandia for the comparative evaluation of shaft locations, would need QA qualifications. It was agreed that for QA purposes, the committee should identify the individuals and the work performed, acknowledging that these are QA level III calculations. A. Matthusen reported that his subcommittee was using SCP 8.4 to evaluate the analyses used, and conclusions drawn with respect to ESF design. Input data are compared to the version 3 of the RIB whenever possible, otherwise judgments are made on values not in the RIB. It was agreed that an assessment of the data in the RIB was required. For parameters not found in the RIB, the committee would recommend the parameters that should be added.

The Chairman distributed the TAR schedule (Attachment 2), and asked that the subcommittee leaders provide a status report to him each afternoon at 4:00. The next general meeting will be 12/22 at 10:30 AM. The subcommittee input must be complete by 1/6/89. It was decided that the subcommittee reports would be as brief as possible, with supporting appendices.

There was discussion on the form of the subcommittee reports to the Chairman. It was decided that each subcommittee report would have documentation to indicate individual committee member concurrence.

Minutes compiled by R.C. Lee:

Date: 1/6/89

Concurrence by:

Date: 1/6/89

Attachment 1

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: 12/14/88

NAME	ORGANIZATION	PHONE
Richard C. Lee	SAIC	702-794 7134
Robert A. Levich	DOE/NV	702-794-7946
CRAIG BENTLEY	USGS	FTS-776-0519
Dwight T. Hoxie	USGS	FTS 776-5019
Ed Kwickus	USGS	FTS 776-6228
Mike Lugo	Weston/SAIC	(202) 646-6756
ARCH GIRDLEY	DOE/YMPO	(702) 794-7584
Michael Nuegele	SAIC	702-794-7638
Ernest Hardin	SAIC	702-794-7617
Felton W. Bingham	SAIC SNL	FTS 844-8816
AUGUST C. MATTHUSEN	SAIC	FTS 544 7625
Keith Kersch	SAIC	FTS 544-7620
Jeff Kimball	DOE/HQ	FTS 896 1063
Joe Tillerson	SNL	FTS 844-5575

Note: there are two TAR meeting attendance lists
for 12/19/88 because one was temporarily misplaced.

Richard C. Lee
TAR Secretary 1/5/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: 12/19/88

NAME	ORGANIZATION	PHONE
Richard C. Lee	SAIC	544-7134
Charles F. Voss	PNL	202 646 5206
John Gardine	SAIC	FTS 544-7749
Jerry L. King	SAIC	FTS 544-7648
Dwight P. Foxie	USGS	FTS 776-5019
Joe Tillerson	SNL	FTS 844-5500
Scott Sinnock	SNL/LV	FTS 544-7200
Scott G. Van Camp	WESTON/WBEC	202/646-6640
John K. Kimball	DOC/HQ	FTS 896 1063
Felton W. Bingham	SNL	FTS 844-8816
August C. Matthews	SAIC	FTS 544-7625
Ernest Hardin	SAIC	702/794-7617

Month... DEC 3

D-37

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____
Date _____	Date <u>19</u> Plenary Session	Date <u>20</u> Subcommittee work	Date <u>21</u> work	Date <u>22</u> Plenary Session	Date <u>23</u> SAIC Holiday	Date <u>24</u>
Date <u>25</u>	Date <u>26</u>	Date <u>27</u> Status Rep. Holiday	Date <u>28</u> Status Rep. Subcommittee homework	Date <u>29</u>	Date <u>30</u>	Date <u>31</u>

Attachment 2

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Date <u>1</u>	Date <u>2</u> Holiday	Date <u>3</u> Plenary Session	Date <u>4</u> Subcommittee Work	Date <u>5</u> Status	Date <u>6</u> Subcommittee Input Complete	Date <u>7</u>
Date <u>8</u>	Date <u>9</u> Full committee review of input	Date <u>10</u>	Date <u>11</u>	Date <u>12</u> Draft Review Record Memo Available	Date <u>13</u>	Date <u>14</u>
	Assemble Draft R.R.M.					
	Reference Verification					
Date <u>15</u>	Date <u>16</u> Federal Holiday	Date <u>17</u>	Date <u>18</u> FREEZE TEXT	Date <u>19</u>	Date <u>20</u> Issue Final Review Record Memorandum	Date _____
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____
Date _____	Date _____	Date _____	Date _____	Date _____	Date _____	Date _____

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 12/22/88
Las Vegas, Nevada, 10:30 AM

A meeting attendance list is contained in Attachment 1.

The Chairman provided a review of the recent QA surveillance.

Status reports were given by the subcommittee leaders, M. Voegele, S. Sinnock, and A. Matthusen. M. Voegele reported that his subcommittee had agreed to the criteria for addressing each of the regulatory requirements, and may want to circulate this among other members of the committee next week. Dick Harrig and Charles Voss are to be added to the subcommittee.

S. Sinnock reported that a 30-page report on the effect of the ESF on site performance and a short summary of their work would be prepared by F. Bingham. The backup studies on travel-time calculations are still in progress.

A. Matthusen reported that all documents to be reviewed were assigned, and that the assignments were more than 50% complete. It was agreed that a geochemist would be required to evaluate effects of fluids on the shaft liner.

An issue was raised concerning the Bertrum Report: the NRC would like the report considered, and who should review it? It was agreed that E. Hardin would review the report.

An issue was raised concerning the level of documentation required for the subcommittees. It was agreed that milestones should be identified, and that the subcommittees should document all concurrence or dissenting opinion by subcommittee members.

Minutes compiled by R.C. Lee: *R.C. Lee*

Date: *1/6/89*

Concurrence by: *James Z. King*

Date: *1/6/89*

Attachment 1

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: 12/22/88

NAME	ORGANIZATION	PHONE
Richard C. Lee	SAIC	FTS 544-7134
W. ARCH GIRDLEY	DOE/EMPO	(202) 294-7584
Ernest Hardin	SAIC	794-7617
Jerry L. King	SAIC	FTS 544-7648
Dermot Ross-Brown	SAIC	(614) 451-2515
Michael D. Vucelja	SAIC	FTS 544-7638
August C. Matthews	SAIC	FTS 544-7625
Scott Sinnock	SNL/LV	" 544-7200
Joe R. Tillerson	SNL	FTS 344-5575
Keith Kerschner	SAIC	FTS 544-7620
Mike LUGO	Weston/Jacobs	(202) 646-6756
JOHN FARDINE	SAIC	FTS 544-7749
Felton Bingham	SNL	FTS 844-8816

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/3/89
Las Vegas, Nevada, 2:30 PM

A meeting attendance list is contained in Attachment 1.

The Chairman reported that the committee has received NRC and State of Nevada comments on the TAR Plan. Subcommittee leaders were asked to review those comments and evaluate what impact the comments may have on their schedule. Subcommittee leaders should also consider whether a DOE management meeting, scheduled for 1/17/89, would impact the committee schedule. Subcommittee leaders should have all reports finalized by 1/6/89.

Status reports were given by the subcommittee leaders, M. Voegele, S. Sinnock, and A. Matthussen.

M. Voegele indicated that a draft requirements document for the Design Acceptability Analysis was prepared for committee approval. There is some uncertainty whether the DAA could be completed by 1/6/89.

S. Sinnock indicated that their subcommittee is about 85% complete on the draft of their review. Ground water travel times would be redone once they receive input data from the hydrologists, otherwise Title II RIB values would be used.

A. Matthussen reported that there would probably be no problem with a draft report by 1/6/89.

A draft of the RRM outline (in Attachment 2) was distributed by the Chairman, and comments were solicited. It was decided that Chapter 2 would be omitted, and that additional Appendices would be added. The TAR Chairman and Secretary will make the appropriate modifications.

Minutes compiled by R.C. Lee:

Date: 1/6/89

Concurrence By:

Date:

Attachment 1

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas NV DATE: 11/03/89

NAME	ORGANIZATION	PHONE
Richard Lee	SAIC	702-794-7134
Ernest Hardin	SAIC	794 7617
Robert A. Leitch	YIMPO	(702) 794-7946
SCOTT VAN CAMP	WESTON/WBEC	202/646-6640
Scott Simpson	SNL/LV	702 774 7200
IRCH GIRDLEY	UNPE	(702) 794-7584
Mike Lugo	Weston/Jacobs	(202) 646-6756
Michael Voegelé	SAIC	544-2638
Joe Tillerson	SNL	844-5575
William E. Wilson	USGS	ATS 776-4920
Felton Bingham	SNL	844-8816
Lucust MATTHUSEN	SAIC/LV	(702) 794-7625
Jerry L. King	SAIC	(702) 794-7648
Keith Kersch	SAIC	(702) 794-7620
Dermot Ross-Brown	SAIC	(614) 451 0515
CLIFFORD NORONHA	WESTON	(202) 646-6768
Jeffrey Kimball	DOE/HQ	(202) 586-1063
CHARLIE VOSS	PNL	202 646-5206

Draft Review Record Memorandum (RRM) Outline

1/3/89

- i. RRM Cover Page with Technical Assessment Review (TAR) Chairman Approval Signature
- ii. Preface and Scope of the Review w/ Signature of TAR Secretary
- iii. Table of Contents

Chapter 1. Introduction

Chapter 2. Findings and Recommendations of the ESF Title-I-Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations (signature by TAR Chairman)

Chapter 3. Documentation of Part I of TAR - Design Acceptability Analysis (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 3.1 Part I - Element 1: Assessment of 10 CFR 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document (SDRD)
- 3.2 Part I - Element 2: Evaluation of Performance/Design Criteria in Current Title I ESF Design Requirements
- 3.3 Part I - Element 3: Assessment of Adequacy of the Current ESF Title I Design Against Design/Performance Criteria
- 3.4 Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title I Design and How Data Uncertainties were Considered
- 3.5 Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures

Chapter 4. Documentation of Part II of TAR - Assessment of Alternative Locations for the ESF (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 4.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming No ESF Present
- 4.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming ESF is Present
- 4.3 Part II - Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site

Appendix A. QMP-02-08

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan (Rev. 8, w/ enclosure of Kale & Stein letter to Gertz and Linehan letter to Stein on NRC concerns)

Appendix C. TAR Team Selection Record and Reviewer-Qualification Documentation

1. TAR Assessment Review Team Selection Record (N-QA-008)
2. Discussion TAR Committee Team Member Independence
3. Employer Certification of Committee Team Member Qualifications and Title I Independence
4. TAR Plan Training Forms (N-AD-077)
5. TAR Questionnaire for Documenting Independence of Design Review Members

Appendix D. Meeting Minutes, Presentation Materials, Including Agenda, and Attendance Lists

Appendix E. Additional Information Provided to Review Team Members that was not contained in the original TAR Package

Appendix F. Correspondence Relating to the TAR

1. Linehan to Stein of 12/19/88 - Comments on TAR Notice
2. Blaylock to Gertz of 12/21/88 - Comments on TAR Notice
3. Blaylock to Gertz of 12/29/88 - Standard Deficiency Reports

Appendix G. TAR Comment Forms (if any)

1. TAR Comment Record/Resolution Sheets (N-QA-006)
2. Comment Resolution Concurrence Forms (if any)

Appendix H. List of Reviewers (By Name, Organization, Discipline)

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/5/89
Las Vegas, Nevada, 10:30 PM

A meeting attendance list is contained in Attachment 1.

The Chairman distributed the Reference Review Memorandum outline (in Attachment 2) and asked for any comments or questions.

The subject of the recent NRC meeting minutes on the ESF DAA (letter of 12/15/88 from Linehan to Stein) was raised. There was concern that the TAR generate design criteria for all of the 10 CFR 60 requirements. The Chairman remarked that criteria are to be developed for only the three previous concerns, but the committee must still address acceptability of Title I design with respect to all 10 CFR 60 requirements.

Status reports were given by the subcommittee leaders, M. Voegele, S. Sinnock, and A. Matthussen.

M. Voegele reported that the three criteria lists are finished and that cover sheets will be signed-off. Individuals have been assigned tasks to see that criteria are satisfied. Groups have been assigned to look at any SDRD shortcomings. Regarding schedule for the draft report, M. Voegele pointed out that the Lahoti regulatory flow-down analysis should be published before the TAR Record Memorandum is finalized.

S. Sinnock reported that the first draft of the Summary and Appendix will be delivered tomorrow.

A. Matthussen reported that the data-reasonableness reviews are on schedule.

Minutes compiled by R.C. Lee: *R.C. Lee*

Date: *1/6/89*

Concurrence by: *James Z. King*

Date: *1/6/89*

Attachment 1

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: 1/5/89

NAME	ORGANIZATION	PHONE
Richard Lee	SAIC	702-794-7134
Jerry King	SAIC	702-794-7648
Keith Kersch	SAIC	702-794-7620
Dermot Ross-Brown	SITIC	614 451 0515
Robert A. Levich	DOE/MMP	702-877-0694.
Bernest Hardin	SAIC	702/794 7617
SCOTT G. VAN CAMP	WESTON/WBEC	202/646-6640
RALPH Cady	DOE/HQ	(202) 586-1223
ARCH GIRDLEY	YMPO	(702) 544-7554
CLIFFORD NORONHA	WESTON	(202) 646-6768
Mike Lugo	Weston/Jacobs	(202) 646-6756
Joe Tillerom	SNL	505-344-5525
Michael D. Voegele	SAIC	702-794-7638
CHARLES F. Voss	PNL	202 646 5206
Jeff Kantall	DOE/HQ	202 586 1063
Felton Bingham	SNL	FTS 844-8816
Nancy Valtura	DOE-QA	794-7972
Scott Sinnock	SNL/LV	FTS 544-7200
AUGUST C. MATTHUSEN	SAIC/LV	FTS 544-7625
William E. Wilson	USGS	FTS 776-4920

Draft Review Record Memorandum (RRM) Outline

1/4/89

- i. RRM Cover Page with Technical Assessment Review (TAR) Chairman Approval Signature
- ii. Executive Summary (including Scope)
- iii. Table of Contents

Chapter 1. Introduction

Chapter 2. Summary of Part I of TAR - Design Acceptability Analysis (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 2.1 Part I - Element 1: Assessment of 10 CFR 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document (SDRD)
- 2.2 Part I - Element 2: Evaluation of Performance/Design Criteria in Current Title I ESF Design Requirements
- 2.3 Part I - Element 3: Assessment of Adequacy of the Current ESF Title I Design Against Design/Performance Criteria
- 2.4 Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title I Design and How Data Uncertainties were Considered
- 2.5 Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures
- 2.6 General Conclusions

Chapter 3. Summary of Part II of TAR - Assessment of Alternative Locations for the ESF (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 3.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming No ESF Present
- 3.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming ESF is Present
- 3.3 Part II - Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site
- 3.4 General Conclusions

Appendix A. QMP-02-08

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan (Rev. 8, w/ enclosure of Kale & Stein letter to Gertz and Linehan letter to Stein on NRC concerns)

Appendix C. TAR Team Selection Record and Reviewer-Qualification Documentation

1. TAR Assessment Review Team Selection Record (N-QA-008)
2. Discussion TAR Committee Team Member Independence
3. Employer Certification of Committee Team Member Qualifications and Title I Independence
4. TAR Plan Training Forms (N-AD-077)
5. TAR Questionnaire for Documenting Independence of Design Review Members

Appendix D. Meeting Minutes, Presentation Materials, Including Agenda, and Attendance Lists

Appendix E. Additional Information Provided to Review Team Members that was not contained in the original TAR Package

Appendix F. Correspondence Relating to the TAR

1. Linehan to Stein of 12/19/88 - Comments on TAR Notice
2. Blaylock to Gertz of 12/21/88 - Comments on TAR Notice
3. Blaylock to Gertz of 12/29/88 - Standard Deficiency Reports
4. Linehan to Stein of 12/15/88 - Minutes from 12/8/88 meeting on ESF Acceptability Analysis

Appendix G. TAR Comment Forms (if any)

1. TAR Comment Record/Resolution Sheets (N-QA-006)
2. Comment Resolution Concurrence Forms (if any)

Appendix H. List of Reviewers (By Name, Organization, Discipline)

Appendix I. Supporting Documentation for Chapter 2

Appendix J. Supporting Documentation for Chapter 3

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/9/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The Chairman distributed the current Record Review Memorandum (RRM) outline (contained Attachment 2) that has modifications to section 2.3. The Chairman noted that Appendix B of the RRM would include documentation on any differences between objectives in the TAR Plan and the final TAR RRM. Comment resolution will be handled via QA Standard Deficiency Report (SDR) rather than through the Interim Change Notice (ICN).

The Chairman reported that an additional QA surveillance on the TAR would be conducted this week. It will begin Wednesday, and is to include technical effectiveness.

Concerning schedule, DOE Headquarters is expecting a draft of the TAR on 1/12. DOE must prepare a cover letter for the NRC based on our draft. Comments and/or suggestions would be approved by the subcommittee's and the records would become part of the RRM.

Subcommittee updates:

A. Matthusen reported some issues raised by the data reasonableness subcommittee review. He is reviewing any design impacts that the Bertram report may have. The review of the Fernandez report indicates a factor of three difference in air flow design, but calculations may be required. The permeability of crushed tuff near the liner could also be an issue.

M. Voegele reported that his group was nearing completion of all tasks.

F. Bingham reporting for S. Sinnocks' group indicated that their text is near completion, and that they are ready for graphics.

The Chairman noted that he is preparing the introduction, and will need assistance on the executive summary.

Minutes compiled by R.C. Lee: *R.C. Lee*

Date: 2/1/89

Concurrence by: *John Z. [Signature]*

Date: 2/1/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 9, 1989

NAME	ORGANIZATION	PHONE
Richard C. Lee	SAIC	702-794-7134
Jerry L. King	SAIC	702-794-7648
Ernest Ross-Brown	SAIC	614-451-0515
Bruce Crowe Tech GIRDLOT	Los Alamos DOE	FTS 544-7096 (702) 794-7584
Michael Vaeyle	SMC	702-794-7638
Paul L. Clone	SAIC.	702-794-7573
CLIFF NORONHA	WESTON	(202) 646-6768
Mike Lugo	Weston/Jacobs	(202) 646-6756
Ralph Cao	DOE/HQ	(202) 586-1223
Joe Tillerson	SNL	505-844-5575
August C. Mathusen	SAIC	702-794-7625
Felton Bingham	SNL	(505) 844-8816
Ernest Hardin	SAIC	712 794 7617

09-Jan-1989

Draft Review Record Memorandum (RRM) Outline

- i. RRM Cover Page with Technical Assessment Review (TAR) Chairman Approval Signature
- ii. Executive Summary (including Scope)
- iii. Table of Contents

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- 2.1 Part I - Element 1: Assessment of 10 CFR 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document (SDRD)
- 2.2 Part I - Element 2: Evaluation of Performance/Design Criteria in Current Title I ESF Design Requirements
- 2.3 Part I - Element 3: Assessment of Adequacy of ESF Title I Design Against Design/Performance Criteria Evaluated in Element 2 and Projection of Impact of Other Criteria Being Generated for Title II Design
- 2.4 Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title I Design and How Data Uncertainties were Considered
- 2.5 Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures
- 2.6 General Conclusions

Chapter 3. Summary of Part II of TAR - Assessment of Alternative Locations for the ESF (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 3.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming No ESF Present
- 3.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming ESF is Present
- 3.3 Part II - Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site
- 3.4 General Conclusions

09-Jan-1989

Appendix A. QMP-02-08

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan (Rev. 8, w/ enclosure of Kale & Stein letter to Gertz and Linehan letter to Stein on NRC concerns)

Appendix C. TAR Team Selection Record and Reviewer-Qualification Documentation

1. TAR Assessment Review Team Selection Record (N-QA-008)
2. Discussion TAR Committee Team Member Independence
3. Employer Certification of Committee Team Member Qualifications and Title I Independence
4. TAR Plan Training Forms (N-AD-077)
5. TAR Questionnaire for Documenting Independence of Design Review Members

Appendix D. Meeting Minutes, Presentation Materials, Including Agenda, and Attendance Lists

Appendix E. Additional Information Provided to Review Team Members that was not contained in the original TAR Package

Appendix F. Correspondence Relating to the TAR

1. Linehan to Stein of 12/19/88 - Comments on TAR Notice
2. Blaylock to Gertz of 12/21/88 - Comments on TAR Notice
3. Blaylock to Gertz of 12/29/88 - Standard Deficiency Reports
4. Linehan to Stein of 12/15/88 - Minutes from 12/8/88 meeting on ESF Acceptability Analysis

Appendix G. TAR Comment Forms (if any)

1. TAR Comment Record/Resolution Sheets (N-QA-006)
2. Comment Resolution Concurrence Forms (if any)

Appendix H. List of Reviewers (By Name, Organization, Discipline)

Appendix I. Supporting Documentation for Chapter 2

Appendix J. Supporting Documentation for Chapter 3

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/11/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The previous QA surveillance was summarized by J. King, A. Matthusen, and M. Voegele. There was an explicit request for TAR conclusions from the surveillance team; conclusions are currently unavailable.

The Chairman reviewed the preliminary draft RRM outline (contained in attachment 2). There is now an Appendix K for supporting documentation to Chapter 3.

The Secretary was directed to begin the task of Reference Verification for the TAR.

Minutes compiled by R.C. Lee: *R.C. Lee*

Date: 2/1/89

Concurrence by: *James Z. King*

Date: 2/1/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 11, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SAIC	702-794-7134
Jerry King	SAIC	Same as last time.
Ernest Hardin	SAIC	702 / 794 7617
J. C. Mathisen	SAIC	702 / 794-7625
Keith Kersch	SAIC	702 / 794-7620
ARCH GIRDLE+	DOE	702 / 794 - 7584
DERMOT ROSS-BROWN	SAIC ..	614 - 51 0515
Mike Lugo	Weston/SAIC	(202) 646-6756
Joe TILLERSON	SNL	505-844-5575
RALPH CADY	DOE/HQ	(202) 586-1223
Michael D Voegelé	SAIC	702-794-7638
Robert A. Levich	DOE/IMP	702-794-7946
CLIFF NORONHA	WESTON	(202) 646-6768

10-Jan-1989

Draft Review Record Memorandum (RRM) Outline

- i. RRM Cover Page with Technical Assessment Review (TAR) Chairman Approval Signature
- ii. Executive Summary
- iii. Table of Contents

Chapter 1. Introduction

Chapter 2. Summary of Part I of TAR - Design Acceptability Analysis (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 2.1 Part I - Element 1: Assessment of 10 CFR 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document (SDRD)
- 2.2 Part I - Element 2: Evaluation of Performance/Design Criteria in Current Title I ESF Design Requirements
- 2.3 Part I - Element 3: Assessment of Adequacy of ESF Title I Design Against Design/Performance Criteria
- 2.4 Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title I Design and How Data Uncertainties were Considered
- 2.5 Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures
- 2.6 General Conclusions

Chapter 3. Summary of Part II of TAR - Assessment of Alternative Locations for the ESF (Each Element Below Will Include Concurrence by Members of the Appropriate Subcommittee)

- 3.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming No ESF Present
- 3.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming ESF is Present
- 3.3 Part II - Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site
- 3.4 General Conclusions

10-Jan-1989

Appendix A. QMP-02-08

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan (Rev. 8, w/ enclosure of Kale & Stein letter to Gertz and Linehan letter to Stein on NRC concerns)
3. Differences between TAR Plan and Conduct of TAR

Appendix C. QA Records

1. QA Level Assignment Sheet
2. TAR Assessment Review Team Selection Record (N-QA-008)
3. Discussion TAR Committee Team Member Independence
4. Employer Certification of Committee Team Member Qualifications and Title I Independence
5. TAR Plan Training Forms (N-AD-077)
6. TAR Questionnaire for Documenting Independence of Design Review Members
7. SDRs

Appendix D. Meeting Minutes, Presentation Materials, Including Agenda, and Attendance Lists

Appendix E. Additional Information Provided to Review Team Members that was not contained in the original TAR Package

Appendix F. Correspondence Relating to the TAR

1. Linehan to Stein of 12/19/88 - Comments on TAR Notice
2. Blaylock to Gertz of 12/21/88 - Comments on TAR Notice
3. Blaylock to Gertz of 12/29/88 - Standard Deficiency Reports
4. Linehan to Stein of 12/15/88 - Minutes from 12/8/88 meeting on ESF Acceptability Analysis

Appendix G. TAR Comment Forms (if any)

1. TAR Comment Record/Resolution Sheets (N-QA-006)
2. Comment Resolution Concurrence Forms (if any)

Appendix H. List of Reviewers (By Name, Organization, Discipline)

Appendix I. ^{Supporting Doc} Report on Design Acceptability Analysis (backup for Chapter 2)

Appendix J. ^{Supporting Doc} ~~Report on~~ Comparative Evaluation of Shaft Locations (backup for Chapter 3)

Appendix K. Supporting Documentation for Comparative Evaluation Report

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/18/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The Chairman gave a summary of the Headquarters briefing on the TAR. It was agreed in the briefing that: (1) the TAR Committee has been given a two-week extension to complete the report; (2) the comment resolution issue will be resolved by use of the QMP 02-08 comment resolution forms (i.e., by complying with QMP-02-08 as it stands, rather than by issuing an ICN); (3) there was no need for the TAR to evaluate the SDRD (it was agreed that the SDRD evaluation would be documented in any case); (4) Design interfaces should be incorporated in the section headings of the TAR Plan; (5) if the Lahoti report is not published before the TAR is completed, Headquarters will provide a letter of assurance that the conclusions of that report were final; and (6) Headquarters would prefer to have ground-water travel-time calculations in the report, if possible.

Minutes compiled by R.C. Lee:

Date: 2/2/89

Concurrence by:

Date: 2/2/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 18, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SMC	544-7134
Jenny King	SAIC	544-7648
Robert A. Levich	DOE/YMCP	544-7946
Keith Kersch	SAIC	(F73) 544-7620
August C. MATTIUSSEN	SAIC	FTS 544-7625
Joe TILLERSON	SNL	FTS 844-5575
Dermot Ross-Brown	SAIC	614 451 0515
W. ALAN GIRDLEY	DOE	544-7584
Ernest Hardin	SAIC	794 7617
Scott SINNOCK	SNL/LU	FTS 544-7200

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/20/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1. L. Hoffman was in attendance to provide advice on technical editing support.

A new schedule for completion of the TAR is contained in Attachment 2.

The Chairman described a new procedure that the TAR is subject to: QMP-17-01. This procedure requires that we list all reference material cited with the appropriate accession number. The TAR Committee will need a master list of the bibliography, and can expect technical editing to assist us.

The Chairman noted that TAR recommendations will be documented on QMP-02-08 comment-resolution-forms; an ICN will not be issued. Comment forms should be complete by Wednesday, the 25th of January.

Minutes compiled by R.C. Lee:

Date: 2/2/89

Concurrence by:

Date: 2/2/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 20, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SMC	794-7134
Jerry L. King	SAIC	794-7648
Keith Kersch	SAIC	794-7620
AUGUST C. MATTHUSEN	SAIC	794-7625
Lynn Hoffman	SAIC	794-7622
Joe Tillerson	SNL	844-5575
ARCH GIRDLEY	DOE	794-7584
Dermat Ross-Brown	SAIC	614-451 0515

15 SUNDAY	16 MONDAY	17 TUESDAY	18 WEDNESDAY	19 THURSDAY	20 FRIDAY	21 SATURDAY
15-150	Martin Luther King Jr. Day 16-110	17-100	18-110	Start Reference Verification 19-100	Start compiling reference material, master list 20-110	Finish draft response to AIRC & State comments 21-110
22	23 Draft comment responses to HQ Start Tech Edit 23-110	24 Finish reviews 24-110	25 Summary Comments on 02-08 forms OK on Labati report (HQ) 25-110	26 Finish draft summaries, Introduction ↓ Finish Appendices 26-110	27 Compile Table of Contents 27-110	28
29	30 Obtain YMP 30-110 No. for report DRAFT RRM to YMAP	31 January 31-110	1 February 1-110 REPRODUCTION (appendix) (maybe the 21 st)	2 REPRODUCTION SHIP! 2-110	3 3-110	4 4-110
5	6	7	8	9	10	11
12	13	14	15	16 RRM & TIR Pkg. to LRC, with references	17	18
19	20 Washington's Birthday (Observed) 20-110	21	22	23	24	25
26	27	28	February			

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/25/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The Chairman reported that an agreement had been reached on the SDR for the TAR Plan: the TAR Plan would be subject to an 06-03 document review and issued as a controlled document under QMP-06-02. After receipt of the Blanchard, Wilmot, and Blaylock comments, the Plan will be identified as Rev. 0. If the TAR Plan differs substantially from the original Plan, additional training may be required.

In regard to TAR comments, it was decided that corrective actions should be on comment sheets, and that specific time frames for corrective action should be specified as well as information on specific tasks (such as whether problems can be addressed in semiannual progress reports for whether the SCP should be revised).

Status reports on text preparation were given by the subcommittee leads. R. Kersch reported on the status of reference verification.

Minutes compiled by R.C. Lee:

Date: 2/1/89

Concurrence by:

Date: 2/2/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 25, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SMC	702-794-7134
Jerry King	SAIC	702-794-7648
Ed Hardin	SAIC	702-794-7617
A.C. Matthews	SAIC	702-794-7625
Keith Kersch	SAIC	702 794-7620
Michael Voegelé	SAIC	702-794-7638
Joe TILLERSON	SNL	844-5575

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/27/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The Chairman asked J. Tillerson for a summary of the meeting between Larry Costin and Bill Grams of REECO. J. Tillerson reported Larry Costin is preparing a letter that will summarize the outcome of the meeting he had with Bill Grams. Reportedly, Gram has three concerns related to the scope of the TAR: (1) the operational area within the dedicated test area is limited and could make support of mining and testing activities difficult; (2) simultaneous mining and testing in close proximity may cause interference problems; and (3) the design does not allow for easy expansion for additional testing without possibly interfering with ongoing testing.

The Chairman reported that he is preparing a response to the LLNL letter regarding the question of their participation in the TAR.

A revised outline for the RRM was distributed and is contained in Attachment 2. Assignments and delivery dates were made on the items in the RRM outline.

Minutes compiled by R.C. Lee:

Date: 2/2/89

Concurrence by:

Date: 2/2/89

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 29, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SMC	FTS 544-7134
Jerry L. King	SAIC	FTS 544-7648
Keith Kersch	SAIC	FTS 544-7620
Lynn Hoffman	SAIC	FTS 544-7622
DE TILKERSON	SNL	FTS 344-5575
Ed Hardin	SAIC	FTS 544-7617
MD Voegelé	SAIC	544-7638
W. A. Girdley	DOE	544-7584
A.C. Matthews	SAIC	FTS 544-7625

27-Jan-1989

Review Record Memorandum (RRM) Outline

i. RRM Cover Page with Technical Assessment Review (TAR) Chairman and YMPO Branch Chief Approval Signatures

ii. Executive Summary

iii. Table of Contents

Chapter 1. Introduction

Chapter 2. Summary of Part I of TAR - Design Acceptability Analysis

- 2.1 Part I - Element 1: Assessment of Coverage by Subsystem Design Requirements Document (SDRD) of the Subset of 10 CFR 60 Requirements Related to Waste Isolation, Test Interference, and Data Representativeness
- 2.2 Part I - Element 2: Identification of Design Interfaces and Assessment of SDRD Performance/Design Criteria for the Subset of 10 CFR 60 Requirements
- 2.3 Part I - Element 3: Assessment of Adequacy of ESF Title-I Design Against Design/Performance Criteria for the Subset of 10 CFR 60 Requirements
- 2.4 Part I - Element 4: Assessment of Appropriateness, Relative to the Subset of 10 CFR 60 Requirements, of Data Used in ESF Title-I Design and How Data Uncertainties Were Considered
- 2.5 Part I - Element 5: Evaluation of Impact of Findings on Design and Development of Recommendations ~~for~~ ^{and} Corrective Measures
- 2.6 Part I - Element 6: Evaluation of Design Impacts of Other Applicable 10 CFR 60 Requirements and Development of Rationale for Deferring Detailed Design/Performance Criteria

Chapter 3. Summary of Part II of TAR - Assessment of Alternative Exploratory Shaft Locations

- 3.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative Exploratory Shaft Locations, Assuming No Exploratory Shaft is Present
- 3.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative Exploratory Shaft Locations, Assuming Exploratory Shaft is Present
- 3.3 Part II - Element 3: Assessment of Alternative Exploratory Shaft Locations Compared to Isolation Potential for the Overall Site
- 3.4 General Conclusions

27-Jan-1989

Appendix A. QMP-02-08, Rev. 0

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan
3. Differences between TAR Plan and Conduct of TAR
4. Project Office Review Comments on Draft TAR Plan and Responses
5. NRC, State, and Project QA Comments on Preliminary Draft TAR Plan and Responses

Appendix C. QA-Related Records

1. QA Level Assignment Sheet
2. TAR Assessment Review Team Selection Record (N-QA-008)
3. Employer Certification of Committee Team Member Qualifications and Independence
4. QMP-02-08 Training Documentation
5. TAR-Plan Training Documentation
6. Questionnaire for Documenting Independence of TAR Team Members
7. SDRs and Observations

Appendix D. Meeting Minutes

Appendix E. Additional Information Provided to Review Team Members that was not contained in the original TAR Package

Appendix F. Correspondence Relating to the TAR

Appendix G. TAR Comment Forms

Appendix H. List of Reviewers (By Name, Organization, Discipline)

Appendix I. Report on Design Acceptability Analysis (backup for Chapter 2)

Appendix J. Report on Comparative Evaluation of Shaft Locations (backup for Chapter 3)

Appendix K. Supporting Documentation for Comparative Evaluation Report

1/26/89 TAR Appendix revision

Appendix I. Supporting Documentation for Design Acceptability Analysis

1. Table of SDRD Function Requirements Applicable to Relevant Section of 10 CFR Part 60
2. Table of Additional Information for SDRD Applicable to Relevant Sections of 10 CFR Part 60
3. ESF Applicable Criteria ~~derived from~~ ^{related to} 10 CFR Part 60 Requirements
4. ESF Criteria Addressed in Title 1 SDRD
5. ESF Title 1 Design Compliance with Criteria Related to 10 CFR Part 60
6. Technical Assessment Reviews to Assess Appropriateness of Data Used in ESF Design

Appendix J. Report on Comparative Evaluation of Waste Isolation Capabilities of Alternative Locations for Exploratory Shafts at Yucca Mountain, Nevada

^{Comparative Evaluation}
Appendix K. Documentation of ~~TAR Subcommittee 3~~ Activities

1. Narrative Synopsis of Subcommittee 3 Activities
2. Correspondence in Support of Subcommittee 3

Jerry, in addition to the reference material that is part of the TAR Data Package, we will also include the following:

1. Originals of all versions of submitted reviews (App. I-6)
2. All Reference Verification material

ESF Title I Design Acceptability Analysis TAR Meeting Minutes 1/30/89
Las Vegas, Nevada

A meeting attendance list is contained in Attachment 1.

The Chairman distributed the DAA status list (contained in Attachment 2) and the revised RRM outline (contained in Attachment 3).

In order to provide DOE a review opportunity, L. Hoffman will require hard-copy of any text by 1/31.

The Chairman solicited comments on the RRM outline and the schedule.

Minutes compiled by R.C. Lee:

Date: 2/2/89

Concurrence by:

Date: 2/2/89 ..

ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS TAR MEETING ATTENDANCE LIST

LOCATION: Las Vegas, NV DATE: Jan 30, 1989

NAME	ORGANIZATION	PHONE
Richard Lee	SMC	FTS 544-7134
E. W. Hardin	SAIC	544 7617
Mike Lugo	Weston/Jacobs	(202) 646-6756
Jerry King	SAIC	FTS 544-7648
Herbert Ross. Brown	SAIC	(614) 451 0515
Jim Sinner	SNL/LV	544-7200
Joe TILLERSON	SNL	344-5575
Michael Voegelé	SMC	544-7638
ARCH GIRDLEY	DOE	544-7584
Lucy (C. M. MATHUSAN)	SAIC	544-7584

Revised 1/28/80: 5 PM
 ** = revised portions

DAA STATUS

Sec/ Ch	Short Title	RP*	No. Pages	% Complete/ Comments	Date Due	Date Done	To CC
** i	Cover (w/YMP #) Cover Page	LVH RCL	1		1/30		
ii	Executive Summary	EH/JK	2-3	EH to draft JK to finalize	1/30		
iii	Table of Contents		3	Editing to prep Final	2/2		
Ch. 1	Introduction	JK/EH	9-10		1/30		
Ch. 2	Summary Part I						
2.1	Part I - Element 1	MDV	6-8	LATE MON	1/30		
2.2	Part I - Element 2	MDV	"	" "			
2.3	Part I - Element 3	JT	15-20	Mon. a.m.	1/30		
2.4	Part I - Element 4	RCL	12-14	6 TABLES (RV)	1/30		<i>signature by Wednesday?</i>
2.5	Part I - Element 5	MDV	10-15	LATE MON	1/30		
**2.6	Part I - Element 6	EH	9	JK to OK EH/JK have file	1/28		
Ch. 3	Summary Part II				1/30		
**3.1	Part II - Element 1	SS		-EH review done -SS to resolve wp problem ASAP	1/28	1/28	XX
**3.2	Part II - Element 2	SS	<u>17</u>	(See RV or LVH) -1 FIGURE7777			
**3.3	Part II - Element 3	SS		-Has Ref List -To EDIT?	1/30		
**3.4	General Conclusions	SS <i>RCL</i>		-LVH has current copy			
<i>Reference</i> Ap. A	QMP-02-08, Rev. 0	JK	12	JK has orig forms		DONE	XX
Ap. B	TAR Notice and Plan	JK					
B-1	TAR Notice	JK	20			DONE	
B-2	TAR Plan	JK	50	TB/issued as con- trolled doc	1/27		
B-3	Differences....	JK	.5	~2 PARAGRAPHS	1/30		

Sec/ Ch	Short Title	RP*	No. Pages	Comments	Date Due	Date Done	To CC
B-4	PO Rev Com & Resp	JK	6	Response NA to data	1/30		
B-5	NRC, St, PO Com...	JK	15	50% COMP	2/1		
Ap. C	QA-Related Records	RCL/JK					
C-1	QA Level Assign Sh	RCL/JK	1			DONE	
C-2	TAR Asses Rev....	RCL/JK	1			DONE	
C-3	Emp Cert/Qual	RCL/JK	60			DONE	
C-4	QMP-02-08 Train Doc	RCL/JK	60	99% COMP	1/30		
C-5	TAR-Plan Train Doc	RCL/JK	50	99% COMP	1/30		
C-6	Ques Doc Ind/Team	RCL/JK	60	95% COMP	1/30	Rec.	
C-7	SDRDs and Obs	JK	10	90% COMP	1/30		
Ap. D	Meeting Minutes	RCL	20	40% COMP	1/30	Thursday	
Ap. E	Add'l Info/rel revised outline	JK	10		1/30	Rec. with	
Ap. F	Corres Rel to TAR	JK	20		1/30		
Ap. G	TAR Comment Forms	MDV	20	CRITICAL PATH??	2/2		
Ap. H XX	List of Reviewers	JK	2	JK has original		DONE	
Ap. I	Supporting Doc/DAA	EH/ML					
I-1	Table SDRD/10CFR60	EH/ML	15-20	WP-RV (TABLES)	1/31		
I-2	Table Addl Info SDRD	EH/ML	15-20	See above	1/30		
I-3	ESF Ap Criteria	MDV/ML	70	WP-MDV	1/30		
I-4	ESF Crit/SDRD	ML	50	WP-RV (TABLES)	1/30		
I-5	ESF T1 Desgn/10CFR60	MDV	350	WP-MDV	1/30		
I-6	TA Rev/Approp Data	AM	150		1/30		

Sec/ Ch	Short Title	RP*	No. Pages	Comments	Date Due	Date Done	To CC
AP. J	Report Comp. Eval.....	SS	100+	-EDIT COMP -GRAPHICS IN PROG	1/30		
Ap. K	Doc Comp Eval....	SS					
K-1	Narrative Synopsis	SS	?	EH to check	1/30		
K-2	Correspondence	SS	?	" " "	1/30		

*RP = RESPONSIBLE PERSON(S)

Key: AM = Augie Mathusen
EH = Ernie Hardin
JK = Jerry King
JT = Joe Tillerson
LVH = Lynn Hoffman
MDV = Mike Voegele
RV = Roberta Vasquez
ML = Mike Lugo
RCL = Rich Lee
SS = Scott Sinnock

30-Jan-1989

11:55 a.m.

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- 2.3 Part I - Element 3: Assessment of Adequacy of ESF Title-I Design Against Criteria Developed for Design Acceptability Analysis
- 2.4 Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title-I Design and How Data Uncertainties Were Considered
- 2.5 Part I - Element 5: Summarization of Recommendations and Proposed Corrective Measures
- 2.6 Part I - Element 6: Qualitative assessment of impacts on design of other applicable 10 CFR 60 Requirements

Chapter 3. Summary of Part II of TAR - Assessment of Alternative Exploratory Shaft Locations

- 3.1 Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative Exploratory Shaft Locations, Assuming No Exploratory Shaft is Present
- 3.2 Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative Exploratory Shaft Locations, Assuming Exploratory Shaft is Present
- 3.3 Part II - Element 3: Assessment of Alternative Exploratory Shaft Locations Compared to Isolation Potential for the Overall Site
- 3.4 General Conclusions

~~2.5 References for Chapter 3.~~
References (see just touch)

30-Jan-1989

Appendix A. QMP-02-08, Rev. 0

Appendix B. TAR Notice and Plan

1. TAR Notice
2. TAR Plan
3. Differences between TAR Plan and Conduct of TAR
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5. NRC and State of Nevada Comments on Preliminary Draft TAR Plan and Responses

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2. TAR Assessment Review Team Selection Record (N-QA-008)
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4. QMP-02-08 Training Documentation
5. TAR-Plan Training Documentation
6. Questionnaire for Documenting Independence of TAR Team Members
7. SDRs and Observations

Appendix D. Meeting Minutes

Appendix E. Identification of Documents utilized in the TAR

1. List of documents in the original TAR Package
2. List of documents added to the TAR Package
3. List of resource documents

Appendix F. Correspondence Relating to the TAR

Appendix G. TAR Comment Forms

Appendix H. List of Reviewers (By Name, Organization, Discipline)

Appendix I. Supporting Documentation for Design Acceptability Analysis

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2. Table of Additional Information for SDRD Applicable to Relevant Sections of 10 CFR Part 60
3. ESF Applicable Criteria derived from 10 CFR Part 60 Requirements
4. ESF Criteria Addressed in Title-I SDRD
5. Assessment of ESF Title-I Design with Design Acceptability Analysis Criteria
6. Technical Assessment Reviews to Assess Appropriateness of Data Used in ESF Design

Appendix J. Report on Comparative Evaluation of Waste Isolation Capabilities of Alternative Locations for Exploratory Shafts at Yucca Mountain, Nevada

Appendix K. *Supporting for conversion location* Documentation of TAR Subcommittee 3 Activities

30-Jan-1989

1. Narrative Synopsis of Subcommittee 3 Activities
2. Correspondence in Support of Subcommittee 3

APPENDIX E

List of Documents Utilized in the TAR

DOCUMENTS UTILIZED IN THE TAR

Documents in Original TAR Package

Title I ESF Design Report (4 volumes, including drawing package)

Nuclear Waste Repository in Tuff Subsurface Facility Conceptual Design
ESF/Repository Interface Control Drawing Number R07048A, Sheets 1-15
(prepared by Sandia National Laboratories)

December, 1987 ESF Subsystem Design Requirements Document (SDRD), including
approved Engineering Change Requests (ECRs)

Documents added to the TAR Package (Reviewed for Data Reasonableness)

Appendix B.2 of the ESF Title I Design Summary Report, Volume 4B,
"Preliminary Evaluation: Three Dimensional Far-Field Analysis for the
Exploratory Shaft Facility".

Bauer, S.J., L.S. Costin, and J.F. Holland, 1988. "Preliminary Analyses in
Support of In Situ Thermomechanical Investigations", SAND88-2785, Sandia
National Laboratories, Albuquerque, NM.

Bertram, S., 1984. "NNWSI Exploratory Shaft Site and Construction Method
Recommendation Report," SAND84-1003, Sandia National Laboratories,
Albuquerque, NM.

Birgersson, L., and I. Neretnieks, 1982. "Diffusion in the Matrix of
Granitic Rock. Field Test in the Stripa Mine, Scientific Basis for
Radioactive Waste Isolation".

Bodvarsson, G. S., A. Niemi, A. Spencer, and M. P. Attanyake. "Preliminary
Calculations of the Effects of Air and Liquid Water-Drilling on Moisture
Conditions in Unsaturated Rocks", LBL-25073.

Buscheck, T. and J. Nitao. "Preliminary Scoping Calculations of Hydrothermal
Flow in Variably Saturated, Fractured, Welded Tuff During the Engineered
Barrier Design Test at the Yucca Mountain Exploratory Shaft Test Site.

Case, J.B. and P.C. Kelsall, 1987. "Modification of Rock Mass Permeability
in the Zone Surrounding a Shaft in Fractured, Welded Tuff", SAND86-7001,
Sandia National Laboratories, Albuquerque, NM.

Costin, L.S., and S.J. Bauer, 1988. "Preliminary Analyses of the Excavation
Investigation Experiments Proposed for the Exploratory Shaft at Yucca
Mountain, Nevada Test Site", SAND87-1575, Sandia National Laboratories,
Albuquerque, NM.

Costin, L.S., and E.P. Chen, 1988. "An Analysis of the G-Tunnel Heated Block
Thermomechanical Response Using a Compliant-Joint Rock-Mass Model",
SAND87-2699, Sandia National Laboratories, Albuquerque, NM.

- Dudley, A.L., R.R. Peters, J.H. Gauthier, M.L. Wilson, M.S. Tierney, E.A. Klavetter, 1988. "Total System Performance Assessment Code (TOSPAC) Volume 1: Physical and Mathematical Bases", SAND85-0002, Sandia National Laboratories, Albuquerque, NM.
- Ehgartner, B. L., 1987. "Sensitivity Analyses of Underground Drift Temperature, Stresses, and Safety Factors to Variation in the Rock Mass Properties of Tuff for a Nuclear Waste Repository Located at Yucca Mountain, Nevada", SAND86-1250, Sandia National Laboratories, Albuquerque, NM.
- Fernandez, J.A., T.E. Hinkebein, and J.B. Case, 1988. "Selected Analyses to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain", SAND85-0598, Sandia National Laboratories, Albuquerque, NM.
- Hill, J., 1985. "Structural Analysis of the NNWSI Exploratory Shaft, SAND84-2354, Sandia National Laboratories, Albuquerque, NM.
- Hopkins, Eaton, and Sinnock 1987. "Effects of Drift Ventilation on Repository Hydrology and Resulting Solute Transport Implications", SAND86-1571, Sandia National Laboratories, Albuquerque, NM.
- Hustrulid, W., 1984. "Lining Considerations for a Circular Vertical Shaft in Generic Tuff", SAND83-7068, Sandia National Laboratories, Albuquerque, NM.
- Johnson, R. L., 1981. "Thermo-Mechanical Scoping Calculations for a High Level Nuclear Waste Repository in Tuff", SAND81-0629, Sandia National Laboratories, Albuquerque, NM.
- Johnson, R. L., and S.J. Bauer, 1987. "Unit Evaluation at Yucca Mountain, Nevada Test Site: Near-Field Thermal and Mechanical Calculations Using the SANDIA-ADINA Code, SAND83-0030, Sandia National Laboratories, Albuquerque, NM.
- Johnstone, J.K., R.R. Peters, and P.F. Gnirk, 1984. "Unit Evaluation at Yucca Mountain, Nevada Test Site: Summary Report and Recommendation, SAND83-0372, Sandia National Laboratories, Albuquerque, NM.
- Kipp, Jr., K. L., 1987. "Effect of Topography on Gas Flow in Unsaturated Fractured Rock: Numerical Simulation," American Geophysical Union Geophysical Monograph 42, D. D. Evans and T. J. Nicholson (eds.), pp. 171-176.
- Kwicklis and Hoxie, 1988. "Numerical Simulation of Liquid-Water Infiltration into a Fractured Welded Tuff". (abstract) USGS.
- Lin, Y. T., M. S. Tierney, 1986. "Preliminary Estimates of Groundwater Travel Time and Radionuclide Transport at the Yucca Mountain Repository Site", SAND85-2701, NNWSI, Sandia National Laboratories, Albuquerque, NM. (SAIC Reference Number: 3798)
- Martinez, Mario J., 1984. "Capillary-Driven Flow in a Fracture Located in a Porous Medium", SAND84-1697, Sandia National Laboratories, Albuquerque, NM.

Nimick, F. B., L. E. Shepard, and T. E. Blejwas, 1988. "Preliminary Evaluation of the Exploratory Shaft Representativeness for the Yucca Mountain Project", SAND87-1685, Sandia National Laboratories, Albuquerque, NM.

Peters, R.R., 1988. "Hydrologic Technical Correspondance in Support of the Site Characterization Plan, Memorandum 3, 4, and 5" SAND88-2784, Sandia National Laboratories, Albuquerque, NM.

Peters, R. R., J. H. Gauthier, and A. L. Dudley, 1986. "The Effect of Percolation Rate on Water-Travel Time in Deep, Partially Saturated Zones", SAND5-0854C, NNWSI, Sandia National Laboratories, Albuquerque, NM. (SAIC Peterson, Eaton, Russo, and Lewin, 1988. "Technical Correspondance in Support of an Evaluation of the Hydrologic Effects of Exploratory Shaft Facility Construction at Yucca Mountain", SAND88-2936, Sandia National Laboratories, Albuquerque, NM.

Reda, D.C., 1986. "Influence of Transverse Microfractures on the Imbibition of Water Into Initially Dry Tuffaceous Rock" in Proceedings Symposium on Flow and Transport THrough Unsaturated Rock, SAND86-0420C, Sandia National Laboratories, Albuquerque, NM.

Reference Information Base, Version 3.001, Issued December, 1987.

Ross, B., 1987. "A Survey of Disruption Scenarios for a High-Level-Waste Repository at Yucca Mountain, Nevada, SAND-7117, Sandia National Laboratories, Albuquerque, NM.

St. John, C.M., 1987. "Interaction of Nuclear Waste Panels with Shafts and Access Ramps for a Potential Repository at Yucca Mountain, SAND84-7213, Sandia National Laboratories, Albuquerque, NM.

St. John, C., 1987. "Investigative Study of the Underground Excavations for a Nuclear Waste Repository in Tuff", SAND83-7451, Sandia National Laboratories, Albuquerque, NM.

St. John, C., 1987. "Reference Thermal and Thermal/Mechanical Analyses of Drifts for Vertical and Horizontal Emplacement of Nuclear Waste in a Repository in Tuff", SAND86-7005, Sandia National Laboratories, Albuquerque, NM.

St. John, C., 1987. "Thermomehcanical Analysis of Underground Excavations in the Vicinity of a Nuclear Waste Isolation Panel," SAND84-7208, Sandia National Laboratories, Albuquerque, NM.

St. John, C. and S. Mitchell, 1987. "Investigation of Excavation Stability in a Finite Repository", SAND86-7011, Sandia National Laboratories, Albuquerque, NM.

Technical Letter Memorandum RSI(ALO)-0037, "Estimates of Expected Values and Ranges of Temperature, Stress, and Strain Along the Exploratory Shaft at the Yucca Mountain Project." Appendix B.3, Vol. 4B, ESF Title I Design Summary Report.

Wang & Narasimhan, 1988. "Hydrologic Modeling of Vertical and Lateral Movement of Partially Saturated Fluid Flow Near a Fault Zone at Yucca Mountain", SAND87-7070, Sandia National Laboratory, Albuquerque, NM.

Water, Waste & Land, Inc., 1986. "Analyses of Observed Flow Between Test Wells USW G-1 and USW UZ-1", NRC Mini Report 6 (SAIC Reference No 3861).

Weeks, E. P., 1987. "Effects of Topography on Gas Flow in Unsaturated Fractured Rock: Concepts and Observations," American Geophysical Union Geophysical Monograph 42, D. D. Evans, and I. J. Nicholson (eds.), pp. 165-170.

West, K. A., 1988. Exploratory Shaft Facility Fluids and Materials Evaluation, LA-11398-MS, Los Alamos National Laboratory, Los Alamos, NM.

Zimmerman, R.M., R.A. Bellman Jr., K.L. Mann, D.P. Zerga, M. Fowler, and R.L. Johnson, 1988. "G-Tunnel Welded Tuff Mining Experiment Evaluations, SAND87-1433, Sandia National Laboratories, Albuquerque, NM.

Resource Documents

de Vries, J.J., 1988. Groundwater Recharge Studies in Semi-Arid Botswana- A Review, in Estimation of Natural Groundwater Recharge, I. Simmers (ed.), D. Reidel Publishing Co., NATO Advanced Study Institute Series, Series C, pp. 339-347.

Lincoln, R.C., 1981. Letter to R.M. Nelson on Shaft Siting Meeting of Sept. 1-3, 1981.

Sandia National Laboratories, 1987. "Site Characterization Plan Conceptual Design Report, SAND84-2641, 6 Vol., Sandia National Laboratories, Albuquerque, N. Mex.

U.S. Department of Energy, 1988. "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility - Technical Oversight Group Report," Washington, D.C.

U.S. Department of Energy, 1988. "Site Characterization Plan, Yucca Mountain Site, Nevada Research and Development Area," Nevada, DOE/RW-0199, Washington, D.C., Section 8.4

Wang, J.S.Y., and T.N. Narasimhan, 1988. Vertical and Lateral Movement of Partially Saturated Fluid Flow Near a Fault Zone, in Annual Report, Earth Sciences Division, LBL-24200, Lawrence Berkeley Laboratory, Berkeley, Cal., pp. 229-234.

APPENDIX F

Correspondence Relating to the TAR

CORRESPONDENCE RELATING TO THE TECHNICAL ASSESSMENT REVIEW

This appendix contains correspondence relating the the Technical Assessment Review (TAR) that is not reproduced elsewhere in the Review Record Memorandum. (Correspondence strictly related to administration of the TAR is not included.)

The following documents are included:

1. November 17, 1988, memorandum from Stephen H. Kale to C. Gertz, "NRC Concerns on Title I Design Control Process"
2. December 8, 1988, letter from Carl P. Gertz to Stephan H. Kale, "Strategy for Responding to U.S. Nuclear Regulatory Commission (NRC) Concerns Regarding the Design Control Process used for the Exploratory Shaft Facility (ESF) Title I Design"
3. December 21, 1988, letter from James Blaylock to Carl P. Gertz, "Comments on the Technical Assessment Review (TAR) Plan Regarding Exploratory Shaft Facility (ESF) Design Control Issues - Design Acceptability Analysis for ESF Title I Design"
4. February 2, 1989, Note to File from Jerry L. King, "December 21, 1988, Letter from James Blaylock to Carl P. Gertz Regarding the TAR Plan"
5. January 6, 1989, letter from L. B. Ballou to Carl P. Gertz, "Implementation of Actions by YMP in Response to NRC Concerns Regarding Control Issues Related to ESF (NN1-1989-0634)"
6. February 2, 1989, Note to File from Jerry L. King, "January 6, 1989, letter from L. B. Ballou to Carl P. Gertz Regarding LLNL Participation in TAR"
7. January 30, 1989, memorandum from Mike Lugo to Jerry L. King, "Verification of DOE/HQ Technical Oversight Group Report"
8. January 31, 1989, letter from Laurence S. Costin to Michael D. Voegele, "Report and Assessment of Concerns Expressed by Bill Grams (REECo) Regarding the ESF Title I Design and Their Relevance the the Three NRC Concerns"

United States Government

Department of Energy

memorandum

DATE: NOV 17 1988

RE: O
ATTN OF: RW-20

SUBJECT: NRC Concerns on Title I Design Control Process

TO: C. Gertz

NRC has expressed concerns relating to the design control process applied to the completion of the ESF Title I design and acceptability of other supporting analyses evaluating the impact of ESF on waste isolation.

As discussed with the NRC and the State of Nevada on November 3, 1988 the DOE must demonstrate that the results of the Title I design are acceptable. Such a demonstration is based on showing that:

- A. The ESF is not expected to adversely impact on the ability of the site to isolate waste.
- B. The ESF construction, operation, and testing are not expected to result in interferences which adversely affect the ability to gather data to support the license application.
- C. As part of the overall site characterization program, the ESF testing is expected to provide data representative of the site conditions needed to support the license application.

We believe that implementation of the following multi-step approach to demonstrate the acceptability of the Title I design and supporting analyses will enhance NRC and State confidence in the results of the ESF Title I design. In addition, it will provide the basis for NRC to evaluate the Title I design against the requirements of 10CFR60. The implementation of the multi-step approach should be viewed as essential to both addressing NRC concerns on Title I design process and for starting Title II design.

Step 1. Documentation

The Project Office should document, (described in Step 2), the design control process and quality assurance that were in place and governed (1) the development of the hierarchy of requirement documents, specifically the incorporation of 10CFR60 requirements, for the ESF, into GR Appendix E, SDRD, and Design Basis, (2) the identification of interfaces between the ESF design, construction, and operation, and the repository and between siting, design, testing, and performance assessment aspects of the program, (3) the analyses and definitions which

led to additional requirements in the SDRD, consisting of shaft location, shaft diameter, second shaft, shaft separation, testing interferences, and testing needs, and, (4) the completion of Title I design and review of the process to ensure that 10CFR60 requirements were incorporated into the design.

The documentation should include the responsible organizations and individuals who performed, reviewed and approved the work, the plans and procedures which governed the performance and review of the work, the quality assurance program the work was performed under, the qualifications of the responsible individuals, results of any management and/or technical assessments performed related to the work, and reports documenting the work.

Step 2. Design Acceptability Analysis

The Project Office should develop and implement a plan to perform a design acceptability analysis that meets the applicable requirements of NNWSI 88-9. The design acceptability analysis should (a) identify all 10 CFR 60 requirements that are applicable to the design and construction of the ESF and (b) evaluate design interfaces such as identified in item (2) of Step 1. The Project Office should either generate design criteria for ESF Title I design based on (a) and (b) or demonstrate how the current design criteria used for ESF Title I design address (a) and (b).

In addition, the Project should analyze the current design against the design criteria to demonstrate that the ESF design and construction satisfy Criteria A, B, and C listed on Page 1. This analysis should also address the appropriateness of the data used in the design and how the uncertainties were considered. This analysis is not intended to demonstrate that the data meets NUREG 1298, but will demonstrate the reasonableness of the data for the type of analysis being performed.

For any area of the ESF Title I design found unacceptable by the Project during this design acceptability analysis, Project should identify the impact on the overall design and the actions to correct the deficiency.

Step 3. Performance Analysis

Task 1:

The project should document the performance analyses that demonstrate the acceptability of the additional requirements in the SDRD, identified in item (3) of Step 1, (e.g., shaft

location, shaft diameter, shaft separation). This includes the references in the Environmental Assessment (EA) and Section 8.4 of the SCP.

Task 2:

To meet the NRC request for information supporting the evaluation of alternative locations for the ESF, a comparative evaluation will be prepared in three parts. These evaluations will consider: (1) current site conditions; (2) changes to these conditions that can reasonably be expected during the next 10,000 years; (3) low probability disruptive events and processes that might occur at the site during the next 10,000 years; and (4) alternative conceptual models of the conditions at the site.

The first part will examine all of the alternative locations in the Bertram report. It will show if any significant differences exist in the capabilities of those locations for providing waste isolation and containment and what influences, if any, these differences might have had on the selection of the preferred shaft location if they had been an explicit part of the selection process.

The second part will examine the alternative locations and will show any significant adverse effects that a shaft might have on the location's ability to contain and isolate waste and what influence, if any, these adverse effects might have had on the selection of the preferred shaft location if they had been an explicit part of the selection process.

The third part will compare the five alternative locations, in regard to waste isolation, with the Yucca Mountain Site. This may include, as appropriate, comparison of factors contributing to waste isolation such as ground-water travel time, thickness of unsaturated tuff below the repository horizon, thickness of zeolite units below the repository horizon, or presence of volcanic glass.

Step 4. Management Review

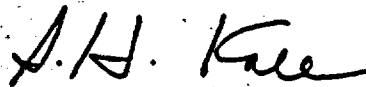
As a fourth step, Headquarters and the Project Office will jointly perform management review of the work being performed to complete Steps 1, 2, and 3. The management review should include such items as the Quality Assurance program plans and procedures the work is being performed under, responsibilities of the organizations and qualification of the individuals performing and reviewing the work, and the acceptance criteria used to evaluate the completed work.

Schedule

Because of the urgency to demonstrate prior to or concurrent with the SCP that the results of the ESF Title I design are acceptable, with respect to waste isolation, the results of Steps 1, 2 and 3 should be available in the same time frame as the release of the SCP (scheduled for the end of December). In addition, the process employed in Step 2, including plan, procedures, quality assurance program the work was performed under, responsible organizations, and planned work products, should be available to discuss with the NRC, State of Nevada, and affected units of local government at a future meeting in December with NRC on the Design Control Process.

It is expected that the project will initiate necessary steps and commit resources in order to complete the work identified above, and that a management plan developed under applicable requirements of NNWSI, 88-9 will be submitted to HQ no later than November 21, 1988.

Should you have any questions on this matter, please contact Ram Lahoti on FTS 896-4099 or Steve Brocoun on FTS 896-9247.



Stephen H. Kale
Acting Associate Director for
Facilities Siting and
Development

cc: R. Stein, RW-30
L. Barrett, RW-3
S. Brocoun, RW-221
J. Hale, RW-222
D. Siefken, WESTON
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M. Cline, WESTON
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Department of Energy

Nevada Operations Office

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Las Vegas, NV 89193-8518

WBS # 1.2.5.2.2

"QA"

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Stephen H. Kale, Associate Director, Facilities Siting and Development, HQ
(FW-20) FORS

STRATEGY FOR RESPONDING TO U.S. NUCLEAR REGULATORY COMMISSION (NRC) CONCERNS
REGARDING THE DESIGN CONTROL PROCESS USED FOR THE EXPLORATORY SHAFT FACILITY
(ESF) TITLE I DESIGN

Reference: Letter, Kale to Gertz, dtd. 11/17/88

This is the strategy to determine the acceptability of Title I ESF design. This strategy incorporates the Yucca Mountain Project Office (Project Office) Quality Management Procedure (QMP)-02-08, Technical Assessment Review (enclosure 1). The selection of QMP-02-08 as the controlling procedure is based on a review of the Project Office Quality Assurance Plan NV/88-9. NV/88-9, Section III (Scientific Investigation and Design Control), Paragraph 5.0 (Technical Reviews), and the definitions in Appendix A for Verification and Technical Review. We believe that QMP-02-08 adequately fulfills the intent and definitions for Technical Review specified in NV/88-9. The documentation requested in the referenced letter will be prepared as a part of the Technical Assessment Review and will become a part of the permanent record (see QMP-02-08, paragraph 3.5).

A detailed action plan to implement the Technical Assessment Review according to QMP-02-08 is currently under development. A draft is expected to be available by December 9, 1988. The plan will provide for the following elements for Steps 2 (Design Acceptability Analysis) and 3 (Performance Analysis) described in the referenced letter.

1. Action Plan: This plan will describe the organizational responsibilities, the content and scope of the tasks to be completed, the individuals responsible for the tasks identified, the records to be prepared and maintained, and the schedule for completing the tasks (see QMP 02-08, paragraph 3.2).
2. Qualification and Training of Staff: The action plan (item 1) will be implemented using qualified individuals. Roles will be defined and individuals will be trained in accordance with their responsibilities assigned in the action plan. Qualifications will be documented and the individuals chosen for this task will be other than those who performed the technical work being reviewed (see QMP-02-08, paragraph 3.1).
3. Documentation Process: Records will be maintained and preserved for all actions related to the Technical Assessment Review. This will include: 1) documents reviewed, 2) comments generated, 3) resolution of review comments, and 4) the Technical Assessment Review results. The record will also include a compilation of all references used. References cited

Ralph Stein

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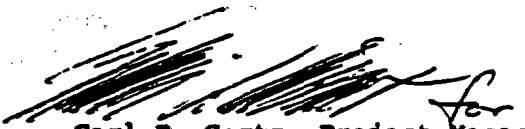
in any reports generated by this process will be verified and the verification records will be preserved (see QMP-02-08, paragraph 3.5).

4. Technical Review: The documents prepared for this task will be reviewed by qualified individuals other than those who performed the technical work being reviewed. The results of these reviews will be documented according to the process described in QMP-02-08 (especially paragraph 5.0), consistent with Item 3.

For Step 1 documentation, (described in the referenced letter) Items 1 through 4 will be used to the extent necessary to aid in the compilation of a historical record for use in this review.

Upon completion of Items 1 through 4, a management review will be conducted by the U.S. Department Of Energy/Headquarters and the Project Office. This review will include the work performed in preparing the plans, documents, procedures, qualification records for individuals, and review results. The management review will ensure that plans are in place to make appropriate modifications to the Title II design process and/or the site testing program as a result of the Technical Assessment Review, if necessary.

If you have any questions about the details in this letter, please contact Maxwell B. Blanchard of my office at FTS 544-7939.


Carl P. Gertz, Project Manager
Yucca Mountain Project Office

YMP:MBB-933

Enclosure:
QMP-02-08

cc w/encl:

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UNCONTROLLED**1.0 PURPOSE AND SCOPE**

This procedure defines the method to be used and responsibilities for performing Technical Assessment Reviews for the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. The requirements of this procedure may be supplemented with further documented guidance that defines the logistics and methodologies to be used in a review.

2.0 APPLICABILITY

This procedure applies to Technical Assessment Reviews conducted by the Waste Management Project Office (WMPO) for the NNWSI Project. A Technical Assessment Review is one of a set of review methods defined for the NNWSI Project in Section 4.2.5 of the Systems Engineering Management Plan (SEMP). This procedure can be used in meeting the requirements for technical reviews defined in the SEMP and in U.S. Department of Energy (DOE) Order 4700.1, Attachment III-1, Page III-47, Section 2.

3.0 DEFINITIONS**3.1 TECHNICAL ASSESSMENT REVIEW**

The Technical Assessment Review is a documented evaluation of technical status, technical progress, or technical merit, in combination or separately. It is performed by qualified individuals other than those who performed the technical work being reviewed, but who may be from the same organization. Technical Assessment Review is a management method that may be used to accomplish such items as the following:

1. Assessing requirements.
2. Determining the degree to which technical work meets requirements.
3. Identifying technical issues in a timely fashion, including interfaces with site and design efforts.
4. Assessing the technical status or technical progress of activities.
5. Providing a basis to accept technical services rendered.

APPROVED BY

Project Manager, T&MS

Date

2 Aug. 1988

WMPO Project Quality Manager

Date

08/03/88

F-8

WMPO Project Manager

Date

8/11/88

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6. Defining and directing necessary changes in accordance with WMPO procedures.

3.2 TECHNICAL ASSESSMENT REVIEW NOTICE

The Technical Assessment Review Notice (Figure 1) is issued by the responsible WMPO Branch Chief, or designee, announcing the Technical Assessment Review. The notice provides the following:

1. Technical Assessment Review scope and purpose, identifying areas and items to be assessed, including an indication of the required depth. This may be accomplished in a variety of ways, including the use of questionnaires, checklists, a list of design requirements, or through other suitable means.
2. Date, time, location, and other logistical information for the Technical Assessment Review meeting.
3. Name of the Technical Assessment Review Team Chairperson.

3.3 TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD

3.3.1 The Technical Assessment Review Team Selection Record (Figure 2) is completed, signed, and dated by the Technical Assessment Review Team Chairperson. It identifies the functions involved in the review, and the names of qualified individuals selected to be on the Technical Assessment Review Team. The review team members are assigned the responsibility for reviewing and providing comments, as applicable, for those functions. The review team members must be other than those who performed the technical work, but they may be from the same organization.

3.3.2 The Technical Assessment Review Team Selection Record includes the documentation of the qualifications of the review team members assigned for the various review functions.

3.4 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Package is a collection of documents (e.g., reports, schedules, plans, and drawings) that provides the information to be assessed by the review team members to achieve the established scope and purpose.



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3.5 REVIEW RECORD MEMORANDUM

The Review Record Memorandum is a documented summary of the Technical Assessment Review prepared by the Secretary, which includes the following:

1. Scope of the review.
2. Technical Assessment Review Notice.
3. Technical Assessment Review Meeting minutes.
4. Technical Assessment Review Team Selection Record.
5. Technical Assessment Review Comment Records identifying comments and resolutions.
6. List of meeting attendees and, when specified, their Technical Assessment Review responsibilities.
7. Correspondence relating to the Technical Assessment Review.
8. Information presented during the Technical Assessment Review meeting and other information provided to the review team members that was not contained in the original Technical Assessment Review Package or in subsequent additions or modifications to the package.
9. Conclusions and recommendations.

3.6 TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

The Technical Assessment Review Comment Record is a form used to document Technical Assessment Review comments and their resolution (Figures 3 and 4).

3.7 TECHNICAL ASSESSMENT REVIEW DATA PACKAGE

The Technical Assessment Review Package is a set of Quality Assurance (QA) records consisting of the Technical Assessment Review Package and the Review Record Memorandum, including any supplements as described in Section 5.5.6.

4.0 RESPONSIBILITIES

4.1 RESPONSIBLE WMPO BRANCH CHIEF OR DESIGNEE

4.1.1 The responsible WMPO Branch Chief or designee shall plan, schedule, and announce the Technical Assessment Review, designate the Technical Assessment Review Chairperson, and distribute the Review Record Memorandum.



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4.1.2 If the responsible WMPO Branch Chief determines that a Project Participant is to be the designee, the responsible WMPO Branch Chief shall document that decision and the designated organization shall prepare and issue the Technical Assessment Review Notice.

4.2 TECHNICAL ASSESSMENT REVIEW CHAIRPERSON

The Technical Assessment Review Chairperson is responsible for the following:

1. Designating the Secretary for the Technical Assessment Review.
2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.
3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill technical disciplines to accomplish the scope and purpose of the review.
4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines.
5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review.
6. Determining the number of reviewers for the Technical Assessment Review Team.
7. Obtaining information for the review from the appropriate Technical Project Officer (TPO) and others, as appropriate.
8. Coordinating the Technical Assessment Review Team, the meeting, and the review process.
9. Issuing the Review Record Memorandum to the responsible WMPO Branch Chief for distribution.
10. Compiling a data package of the Technical Assessment Review.

4.3 SECRETARY

The Secretary documents the Technical Assessment Review Team activities. Specifically, the Secretary records the meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5).



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4.4 TECHNICAL ASSESSMENT REVIEW TEAM MEMBERS

It is the responsibility of the review team members to review and provide comments in their technical area, as designated by the Chairperson, and to participate in the evaluation of proposed resolutions.

5.0 PROCEDURE

5.1 INITIATION OF THE TECHNICAL ASSESSMENT REVIEW

The responsible WMPO Branch Chief or designee plans, scopes, and schedules the Technical Assessment Review and designates the Technical Assessment Review Chairperson. The responsible WMPO Branch Chief or designee also issues the Technical Assessment Review Notice to Quality Assurance, Regulatory Compliance, and others, as appropriate.

5.2 TEAM SELECTION

5.2.1 The Technical Assessment Review Chairperson performs the following:

1. Designating the Secretary for the Technical Assessment Review.
2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.
3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill the technical disciplines to accomplish the scope and purpose of the review.
4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines, as described in Section 5.2.2
5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review, and signing and dating the Technical Assessment Review Team Selection Record(s).
6. Determining the number of reviewers for the Technical Assessment Review Team.
7. Ensuring that assigned Review Team Members are trained to this procedure and other applicable documents.

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5.2.2 The Technical Assessment Review Chairperson requests the following information for each of the review team members: name of the person and a statement that the review team member meets the education, experience, and independence qualifications established for the review. This information is to be provided by the employer of the review team member.

5.2.3 If a review team member's employer is an agency outside of the NNWSI Project, the chairperson is responsible for notifying the agency that the documentation verifying the education, experience, and independence of the review team member must be obtained and retained by that agency. This documentation shall be made available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the DOE. In addition, the agency shall be required to notify the WMPO prior to destruction of this verification documentation.

5.3 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Chairperson obtains the information for the review from the appropriate TPO and others, as appropriate.

5.4 TECHNICAL ASSESSMENT REVIEW

5.4.1 The review team members review the material and document their comments on Technical Assessment Review Comment Records. If a review team member has no comment, this is documented on a Technical Assessment Review Comment Record.

5.4.2 The Secretary records meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5). The Technical Assessment Review Chairperson reviews, signs, and dates the Review Record Memorandum.

5.5 RESOLUTION OF TECHNICAL ASSESSMENT REVIEW COMMENTS

5.5.1 The Technical Assessment Review Chairperson obtains resolutions for the Technical Assessment Review comments from the appropriate TPO.

5.5.2 The Technical Assessment Review Chairperson coordinates the team's evaluation of the resolutions obtained in Section 5.5.1. After deciding the appropriateness of the resolutions, such acknowledgment is documented to the appropriate TPO.

5.5.3 Any unresolved comments are referred by the Chairperson to the appropriate TPO for resolution. (The appropriate TPO is the one who has responsibility for the subject of the unresolved comment.)



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5.5.4 The Chairperson, upon submittal of a review comment resolution by the appropriate TPO, shall ensure that the resolution is provided to the review team member and the responsible WMPO Branch Chief.

5.5.5 The review team member who had the unresolved comment shall evaluate the provided comment resolution, and either:

1. Sign and date the review comment resolution (according to the Chairperson's instruction) to indicate agreement, and return it to the Chairperson.
2. If a disagreement exists, attempt to achieve an agreement, (via the Chairperson) with the appropriate TPO. If agreement cannot be reached, provide the documented basis for the disagreement to the Chairperson and request assistance from successively higher levels of management.

5.5.6 The Chairperson may complete the Review Record Memorandum with a documented unresolved comment; however, supplements must be provided to the memorandum as the appeals process is pursued, such that a complete record of the comment is retained as a QA record.

5.6 REVIEW RECORD MEMORANDUM

The Technical Assessment Review Chairperson issues the Review Record Memorandum to the responsible WMPO Branch Chief for distribution to the TPO(s) and others, as appropriate.

5.7 CLOSURE OF RESOLUTION

The responsible WMPO Branch Chief or designee shall ensure that the appropriate TPO satisfies and closes out the commitments made in resolutions to the Technical Assessment Review comments.

5.8 TECHNICAL ASSESSMENT REVIEW DOCUMENTATION

The Technical Assessment Review Chairperson shall (1) compile a data package relative to the Technical Assessment Review that consists of the Technical Assessment Review Package and the Review Record Memorandum (including any supplements as described in Section 5.5.6) and (2) provide for disposition of the data package in accordance with Section 8.0.



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6.0 REFERENCES

The latest revisions of the following apply:

NNWSI/88-3, NNWSI Project Systems Engineering Management Plan

DOE Order 4700.1, Project Management System

QMP-17-01, QA Records

7.0 FIGURES

At a minimum, the information needs on the forms shown on the following figures shall be satisfied. This may be accomplished by the use of the form itself or a suitable alternate.

Figure 1, Technical Assessment Review Notice

Figure 2, Technical Assessment Review Team Selection Record

Figure 3, Technical Assessment Review Comment Record

Figure 4, Technical Assessment Review Comment Record Continuation Sheet

8.0 QA RECORDS

The following are QA records and are maintained in accordance with QMP-17-01, QA Records.

1. Technical Assessment Review Package.
2. Review Record Memorandum (including any supplements as described in Section 5.5.6).



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TECHNICAL ASSESSMENT REVIEW NOTICE		N-QA-010 7/88
To _____	Date _____	
Technical Area to be Reviewed _____		
WBS No.: _____		
Review Date _____	Location _____	Time _____
Technical Assessment Review Chairperson _____		
<p>Based on review of the qualification documentation, this Technical Assessment Review Chairperson is qualified to execute the responsibilities of QMP-02-08 with respect to the scope and purpose of this Review.</p>		
<p>Scope of Technical Assessment Review:</p>		
<p>Purpose of Technical Assessment Review:</p>		
Signed _____		
Attachments:		

Figure 1. Technical Assessment Review Notice.

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Figure 2. Technical Assessment Review Team Selection Record.

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Figure 3. Technical Assessment Review Comment Record.

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Figure 4. Technical Assessment Review Comment Record Continuation Sheet.



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Carl P. Gertz, Project Manager, YMP, NV

COMMENTS ON THE TECHNICAL ASSESSMENT REVIEW (TAR) PLAN REGARDING EXPLORATORY SHAFT FACILITY (ESF) DESIGN CONTROL ISSUES - DESIGN ACCEPTABILITY ANALYSIS FOR ESF TITLE I DESIGN

Because the outcome of the subject TAR is an important element in responding to the U.S. Nuclear Regulatory Commission's (NRC) concerns regarding the ESF Title I design acceptability, the nature and conduct of such a review should be beyond reproach. In order to enhance the likelihood of success regarding the nature and conduct of the TAR, the Yucca Mountain Project Office Quality Assurance (QA) staff has reviewed several revisions of the TAR plan and provided formal comments on each text. Although the comments have not been formally resolved, representatives of the Regulatory and Site Evaluation Division and Science Applications International Corporation have made a valid attempt to incorporate some of the QA concerns into the plan.

Because of the importance of this review and because of the aggressive review schedule, I feel it is necessary to direct your attention to areas in the plan that need improvement to assure the review process is above reproach. These are:

1. Independence of the review team.
2. Definition and guidance for conducting a comparative evaluation of alternative ESF locations.
3. Definition of those items within the ESF that are subject to the requirements of 10 CFR 60.
4. Instructions on the process by which the review team arrives at and documents conclusions and recommendations, including the use of consensus balloting and documentation of dissenting opinions.

The plan currently requires each member of the review team to be independent of documents being reviewed to the extent that they were not principal contributors to these documents. This guidance is appropriate for most reviews of this type, however, for this particular review, it is not sufficient. In addition to this guidance, it is appropriate for this review to require that each team have representation by one or more members independent of funding considerations and therefore independent of the Yucca Mountain Project.

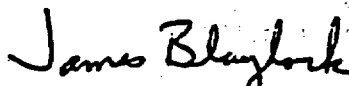
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The plan currently provides guidance regarding the performance of a comparative evaluation of alternatives to ESF locations. This evaluation is expected to address the requirements of 10 CFR 60.21. However, the conduct of this evaluation involves establishing several essential assumptions that the plan does not provide for. These are: (a) definition of which features within the ESF are considered "major design features" and (b) definition of which of these major design features are important to waste isolation. Unless an extremely conservative assumption is made (such as the entire ESF is important to waste isolation) the establishment of assumption (b) requires the implementation of one of the Q-List Administrative Procedures regarding the identification of items important to waste isolation. This procedure is now in draft form and as such will not be available for use in this review.

The plan currently requires use of a draft Office of Civilian Radioactive Waste Management document to describe which 10 CFR 60 requirements are applicable to the ESF. The fact that this document is in draft form detracts from the credibility of the review. Beyond this, it is not clear as to how this document allocates the requirements of 10 CFR 60 to items/activities in the ESF without first determining which of these items/activities are important to safety or waste isolation.

The plan currently does not contain sufficient instructions to implement a process of reviewing, developing/documenting conclusions, and formulating recommendations. Such instructions are essential to the success of the review process. These instructions must clearly indicate how the review team documents their activities, conclusions and how the team arrives at recommendations. The process of developing recommendations must include provisions for the documentation of dissenting opinions.

The foregoing comments are provided to assist in the implementation of a successful review. If you have any questions regarding this matter, please contact me or Nancy A. Voltura of my staff.



James Blaylock
Project Quality Manager
Yucca Mountain Project Office

YMP:JB-1126

CC:

L. H. Barrett, HQ (RW-3) FORS
Ralph Stein, HQ (RW-30) FORS
S. H. Kale, HQ (RW-20) FORS
J. A. Jardine, SAIC, Las Vegas, NV
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E. H. Petrie, YMP, NV
M. B. Blanchard, YMP, NV
R. A. Levich, YMP, NV

DATE: February 2, 1989

FROM: Jerry L. King

TO: TAR File

SUBJECT: DECEMBER 21, 1988, LETTER FROM JAMES BLAYLOCK TO CARL P. GERTZ
REGARDING THE TAR PLAN

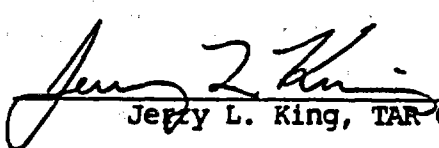
In a December 21, 1989, letter to Carl P. Gertz, Project Manager, Yucca Mountain Project (YMP), James Blaylock, Project Quality Manager, Yucca Mountain Project Office, stated that there were four areas in the TAR Plan which needed improvement to assure the review process is above reproach. This Memorandum to File discusses each of the four areas.

The first area of concern was the independence of the review team. The Project Quality Manager (PQM) stated that, "for this particular review," the team should have members who are independent of funding considerations, i.e., independent of the Yucca Mountain Project. DOE Headquarters (HQ) and YMP Management explicitly considered the possibility of using outside reviewers and opted instead to utilize YMP and HQ personnel who are familiar with the Project and the site and who, therefore, could conduct a review that is both thorough and timely. The review team is composed of highly qualified YMP and HQ personnel who were neither principal contributors to the ESF Title I design nor to the Subsystems Design Requirements Document which was used for the Title I design. This approach to formulating the review team (i.e., the primary consideration being technical qualifications rather than independence of funding considerations) is consonant with the NRC guidance provided for peer reviews (see NUREG-1297, Peer Review for High-Level Nuclear Waste Repositories, Page 23, Response to Comment #2-4).

The second area of concern expressed by the PQM was the guidance provided in the Plan regarding the performance of a comparative evaluation of alternative ESF locations that is "expected to address the requirements of 10 CFR 60.21." The PQM notes that this evaluation would involve establishing several assumptions that the Plan does not provide for, namely, the definition of which features within the ESF are considered major design features and the definition of which of these major design features are important to waste isolation. 10 CFR 60.21(c)(1)(ii)(D) requires that a comparative evaluation of alternatives to the major design features that are important to waste isolation be included in the Safety Analysis Report, which is to accompany the License Application. However, the comparative evaluation of alternative exploratory shaft locations that was performed as part of the TAR was not intended to address this requirement. The scope of the comparative evaluation was limited to the identification of significant differences in the waste-isolation potential of alternative exploratory-shaft locations, with and without a shaft present, and an assessment the influence any such differences might have had on the choice of the preferred shaft location, had they been an explicit consideration in the original location-selection process. The comparative evaluation, thus, did not require the identification of major design features that are important to waste isolation.

The required use of a draft DOE document, "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility, Technical Oversight Group Report," was the PQM's third stated area of concern. The Technical Oversight Group, which developed the subject report, had completed its deliberations when the TAR was initiated and it was understood that the relevant content of the report, i.e., the determination of the ESF-applicable portions of 10 CFR Part 60, was not subject to change before publication. As a precaution, a principal author of the subject report who is a member of the TAR Team was charged with apprising the TAR Team of any potentially significant changes to the draft report. In a January 18, 1989 letter to C. Gertz, Stephen H. Kale, Acting Associate Director, Office of Facilities Siting and Development (OFSD), confirmed that the report had been accepted by the OFSD as a final document. Mike Lugo, Chairperson of the Technical Oversight Group and member of the TAR Team, verified that no changes had been made to the draft report in a January 30, 1989 memorandum to Jerry L. King, TAR Chairperson. The Kale letter and Lugo memorandum are included in Appendix F of the Review Record Memorandum (RRM).

The fourth and last area of concern identified by the PQM is that "the plan does not contain sufficient instructions to implement a process of reviewing, developing/documenting conclusions, and formulating recommendations" and that the "process of developing recommendations must include provisions for the documentation of dissenting opinions." The development of review criteria and a methodology for developing and documenting conclusions and recommendations was an intermediate objective of the TAR. The TAR Team developed a process involving subcommittees for developing and documenting criteria, conclusions and recommendations, within the procedural constraints imposed by the controlling procedure, QMP-02-08, Rev. 0. A detailed description of this process is provided in the RRM. The concern regarding provisions for documenting dissenting opinions was well-founded and was addressed in the final TAR Plan. It turned out, however, that there were no unresolved differing professional opinions among the TAR Team members.

 2/2/89
Jerry L. King, TAR Chairperson

1. The independence issue of the review team focused only on the individual's role in ESF Title I design and the SDRD used for Title I design. The question of independence is related to subsequent activities by Mike Lugo and his role in the draft DOE document, "Applicability of 10CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility, Technical Oversight Group Report" was unanswered. Jerry clarified that the subject report was not technically reviewed by Mike Lugo, a principal author, or other members of the review team. The Mike Lugo role apprising the TAR team of any potentially significant changes consisted of certification that the draft report did not change at all during the course of the Design Acceptability Analysis.
2. It was clarified that the DOE has taken the position that 10CFR 60.21 is inappropriate for the comparative evaluation of the alternative ESF locations. As such there is no need to identify the major design features and to assess the impact of these features with respect to waste isolation in the proposed alternate locations.
3. The TAR initially did not require resolution of all comments. This left the question of whether the TAR members were discouraged from expressing differing professional opinions. This position was reversed. Jerry clarified that recommendations developed through the review process represented consensus by all team members. This consensus was documented through concurrence by all team members on the output product of the review team. Jerry King committed to writing a clarification of this memo to incorporate the resolutions identified above.

James Blyford
Project Quality Mgr.

2/8/89

Page 2A



NWM:89-081

Lawrence Livermore National Laboratory

WBS # 1.2.6

I-3882
ACTION *YMP*
INFO _____
AMA _____
ANISH _____

January 6, 1989

Carl P. Gertz, Project Manager
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

IMPLEMENTATION OF ACTIONS BY YMP IN RESPONSE TO NRC CONCERNS REGARDING CONTROL ISSUES RELATED TO ESF (NN1-1989-0634)

The above referenced letter, dated December 12, 1988 that requested assistance in technical assessment review of the acceptability of the Title I ESF design control process did not identify LLNL as a participant. As such, this action item is not applicable to LLNL. Further, since the letter arrived on December 19 and was calling for a kick-off meeting for December 12-13, it would have been impossible for LLNL to participate.

I would like to raise concern that Item 1 of the NRC's concerns deals with long-term waste isolation capability of the site. The waste package plays a major role in isolation, and ESF design potentially could impact the Waste Package. It seems appropriate, therefore, to have LLNL representation in this process.

[Signature]

L.B. Ballou
LLNL Acting Technical Project
Officer for Yucca Mtn. Project

xc: R.A. Levich, YMPO
J.L. King, SAIC

ACTION
CC: *LEVICH*
CC: *WILMOT*
CC: *PETRIE*
CC: *BACA*
CC: *ISRII*
CC: *ROBSON*
CC: *EDWARDS*
CC: *MORLEY*
CC: *SKOUSEN*
CC: _____

REC'D IN WMPO
1-12-89

DATE: February 2, 1989

FROM: Jerry L. King

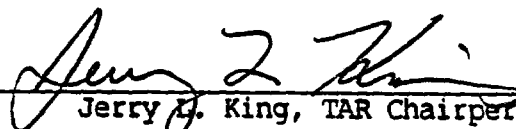
TO: TAR File

SUBJECT: JANUARY 6, 1989, LETTER FROM L. B. BALLOU TO CARL P. GERTZ
REGARDING LLNL PARTICIPATION IN TAR

No TAR Team member was an employee of Lawrence Livermore National Laboratory (LLNL). In a January 6, 1988, letter to Carl P. Gertz, Project Manager, Yucca Mountain Project Office, L. B. Ballou, LLNL Acting Technical Project Officer for the Yucca Mountain Project, stated that LLNL representation in the TAR would seem to be appropriate because ESF design potentially could impact the waste package.

Per QMP-02-08, Rev. 0, the TAR Chairperson determined the technical disciplines to be used to accomplish the scope and purpose of the review, establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill technical disciplines, and the number of reviewers for the TAR Team. TAR Team members were chosen based on their technical qualifications, independence, familiarity with the Yucca Mountain Project, availability, and the need for a manageable number of participants.

During the course of the TAR, TAR Team members identified additional expertise that was needed on the TAR Team; additional Team Members were accordingly trained and added to the TAR Team (see TAR Team Selection Record, Appendix C-2). A geochemist, in particular, was added to the Team, in part, to address design criteria related to controls on materials introduced during construction that could potentially impact waste-package performance, e.g., controls on the chemistry of water used in ESF construction. The TAR Chairperson recognizes the need for attention to organizational interfaces, and would encourage LLNL participation in any future such reviews of ESF design. However, the final TAR Team embodied sufficient program knowledge and technical expertise to accomplish the scope and purpose of the TAR.

 2/2/89
Jerry L. King, TAR Chairperson

Sandia National Laboratories

Albuquerque, New Mexico 87185

January 31, 1989

Michael D. Voegele, Chairman
Subcommittee 1, Technical Assessment Review Team
ESF 100%-Title-I Design
Science Applications International Corporation
The Valley Bank Center
101 Convention Center Drive, Suite 407
Las Vegas, NV 89109

Dear Mike:

Subject: Report and Assessment of Concerns Expressed by Bill Grams (REECO)
Regarding the ESF Title I Design and Their Relevance to the Three
NRC Concerns.

As part of the Subcommittee's evaluation of the ESF Title I design, I contacted Bill Grams of Reynolds Electrical & Engineering Co, Inc. (REECO) in Las Vegas on January 26, 1989 to discuss and document his concerns regarding certain aspects of the ESF Title I design. While a wide range of topics were discussed, this letter is intended to document only those concerns that are within the scope of the Technical Assessment Review (TAR) committee evaluation of adequacy of the ESF Title I design with respect to the NRC's three principal concerns.

The Grams concerns about the Title I design fall into three principal areas:

- (1) Concern over the limited amount of operational area within the dedicated test area, which could make operational support of mining and testing activities difficult.
- (2) That a potential for construction-to-test interference exists in situations where mining and testing may be going on simultaneously and in close proximity.
- (3) That the design does not allow for easy expansion for additional testing within the dedicated test area without possible interference with ongoing testing.

It should be made clear that none of the Grams concerns were of a nature that would lead one to conclude that any of the specific criteria developed for Title I design (ESF Title I design SDRD) were not correct or that any of the specific criteria were not met by the design. Grams concluded that the Title I design adequately met the design criteria in the ESF SDRD, but suggested that his concerns arose because of the preliminary nature of the Title I design, which did not provide sufficient detail in some areas to allow a complete evaluation. It is anticipated by Grams that all of his concerns (discussed in more detail below) would be fully addressed in the

Title II design. My evaluation of the concerns and their relation to the design criteria related to 10 CFR 60 (and the three NRC concerns) is that they are within the scope of the design criteria that have been previously evaluated by this TAR Committee. Thus, these concerns do not require alteration of or additions to the criteria already developed and evaluated.

The specifics of each of the concerns are briefly discussed and evaluated below:

1. Grams' concern is that the layout of the main test level of the ESF does not contain sufficient operational area designated for such activities as support of experiment construction and maintenance, constructor administration, and other support functions (such as lunch rooms etc.). Support of experiment construction requires additional shop, storage, and maintenance areas because of the large amount of equipment that needs to be readily available to support the testing effort. The Title I design layout assumed that such equipment could be stored at the surface, brought underground only when needed, and hoisted back to the surface for storage. Grams does not agree with this assumption. REECO has submitted an Engineering Change Request (ECR) to provide more operational area for the above stated activities. This ECR is currently being evaluated by the Interface Coordination Working Group (ICWG). The TAR committee evaluations of Criteria related to 10 CFR 60.133(b) and 10 CFR 60.137 (Criteria 2.4.6.3, 2.4.6.5, 2.8.6.1, 2.8.6.3, and 2.8.6.5) have concluded that sufficient operational space and flexibility for use of the space are incorporated in the design to adequately meet the criteria for Title I design.
2. There is a concern that there is a potential for interference between operations and construction activities and the testing program in situations where mining and testing may be required to proceed simultaneously and in close proximity. Specifically cited were the potential for interference during the mining of the Sequential Drift Mining (SDM) experiment and possible interferences that may arise if development of new test areas in the dedicated test area is required after most of the experiments in that area have been initiated. Both of these interference concerns are related to the question of whether the overpressures, vibrations, rock fly, and dust associated with construction blasting would interfere with test measurements being made nearby. The results of welded tuff mining evaluation reported by Zimmerman et al. (1988) showed that, with the use of controlled blasting methods, geotechnical instrumentation installed in the rock from adjacent access drifts and in the test drift itself within 1.0 m of the blast face were not affected significantly by construction drilling or blasting. These test results were cited in the SCP (Section 8.4.2.3.6.2) evaluation of construction-to-test interference and by the TAR committee to support evaluations of design compliance with criteria related to 10 CFR 60.133(e)(2) (criteria 2.6.4.2, 2.6.5.2, 2.6.6.3, and 2.6.8.1). The test drifts in the ESF will be larger than those used in the G-Tunnel

study and the effect of the increase in scale (including the additional quantities of explosive that will be required to full-face blast a larger drift size) on the potential for interference with measurement instrumentation cannot yet be directly assessed. In addition, studies to develop the methodology and procedures for control blasting in the ESF are not yet complete, but are expected to incorporate sufficient controls to allow blasting near test instrumentation without damage or loss of data. It is a recommendation of the TAR committee (based on their evaluation of the design criteria related to 10 CFR 60) that these studies and procedures be completed as part of the Title II design. Further, construction of the ESF is phased such that early testing in the shafts and in the upper demonstration breakout room will provide the opportunity to demonstrate the accuracy and survivability of the instrumentation when used in close proximity to construction activities. If construction or test procedures are found to be inadequate, they can be revised before construction on the main test level is started.

It is my opinion that Mr. Grams concerns regarding the potential for construction interference are valid and based on practical experience. Similar concerns were addressed by the TAR committee in its evaluation of design criteria related to 10 CFR 60 and NRC Concern #2. Based on my evaluation of the design and the related design criteria, I conclude that it is the intent of the design to incorporate sufficient controls on the construction methods employed in the ESF that construction-to-test interference of the nature discussed above will be adequately addressed. Because construction methods were not specified in detail in the Title I design, a complete evaluation cannot be made; but it is felt that the treatment is adequate for Title I design.

3. The concern with the ease of expansion of the test facility within the dedicated test area is related to the potential interference with ongoing tests if additional mining is required in the dedicated test area. The Title I design allowed for expansion of the test area but to do this would require mining and hauling along panel access drift #2. Both the sequential drift mining and the waste package test drifts are located off this drift. Thus, partial loss of the isolation of test areas from construction operations may occur. In addition, to initiate a drift into the area set aside for additional development would require blasting adjacent to the waste package tests until the drift was driven beyond the ends of the waste package test drifts. Similar concerns were addressed by the TAR committee in their evaluations of design criteria related to 10 CFR 60.133(b) (criteria 2.4.6.1, 2.4.6.2, 2.4.6.3, and 2.4.6.5). That evaluation concluded that, while the layout may not represent the optimum configuration for reduction of construction interferences resulting from expansion of the test facility within the dedicated test area, it was adequate to meet the requirements set forth in the regulations and criteria. My conclusion, regarding The initial disturbance of blasting near the end of panel access drift #2 is similar to that noted under the second concern, i.e. that the controls for

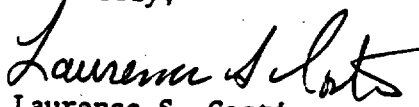
M. D. Voegele

-4-

January 31, 1989

construction blasting are intended to be sufficient to allow mining in areas adjacent to ongoing tests. However, a complete evaluation cannot be made until the controls and construction procedures are fully developed and validated (validation will occur during initial stages of construction, as noted in #2 above.) The layout is such that the actual test areas within the waste package test drifts are well isolated from activities in panel access drift #2. The three sequential drift mining drifts are open to the access drift; but, as noted under #2, the instrumentation is capable of sustained measurement close to active mining. Because of sequencing of the tests and construction development the SDM test should be completed before further mining in the access drift is necessary. Other tests that may be conducted in the SDM drifts (such as joint strength or plate loading tests) would not be affected by mine traffic in the access drift. However, mining operations to extend the test facility while tests are being conducted may present safety hazards to personnel in the test areas which would have to be addressed, but are outside the scope of this committee's activities.

Sincerely,


Laurence S. Costin
Geotechnical Design, 6314

Copy to:

W. Grams, REEC

6310 J. E. Stiegler

6314 J. R. Tillerson

6314 L. S. Costin

6310 60/12462/DIM-231/1.1/Q1

YMP CF

MEMORANDUM

DATE: January 30, 1989

TO: Jerry L. King

FROM: Mike Lugo 

SUBJECT: Verification of DOE/HQ Technical Oversight Group Report

On January 18, 1989, DOE/HQ accepted the report entitled "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility - Technical Oversight Group Report," dated December, 1988, and provided it to the project office as a final document for use in the Technical Assessment Review (TAR) (see attached memo). When this report was being prepared by the Technical Oversight Group in December 1988, a copy was provided to the TAR team for use as draft input. As chairman of the Technical Oversight Group, I have verified that no changes were made to the draft report and hence the information in the final report is the same as that used by the TAR team.

ML:rlv

Enclosure:
As stated

United States Government

Department of Energy

memorandum

DATE: JAN 18 1989

REPLY TO
ATTN OF: RW-20

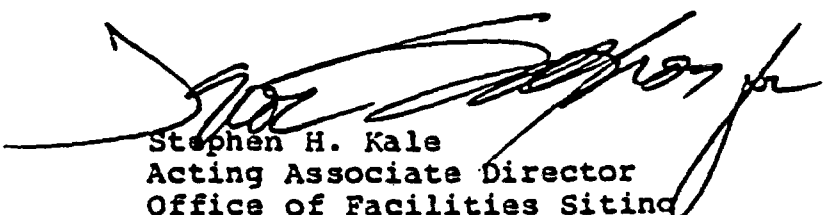
SUBJECT: Transmittal of Final Report "Applicability of 10 CFR 60
Requirements to the Yucca Mountain Exploratory Shaft Facility"

TO: C. Gertz

The report titled "Applicability of the 10 CFR 60 Requirements to the Yucca Mountain Exploratory Shaft Facility" prepared by the independent review board is accepted by the Office of Facilities Siting and Development (OFSD). This report is provided to the project office as a final document for use in the finalization of the Technical Assessment Review (TAR). A draft version was earlier provided to YMPO for use in preparation of the Design Acceptability Analysis (DAA).

The recommendations contained in the subject report were used to prepare a change proposal for revising Appendix E of the Generic Requirements Document (OGR/B-2). This was submitted to the HQ Program Element (PE) Change Control Board on December 22, 1988. Though we anticipate no changes to the Baseline Change Proposal (BCP), it is possible that the Change Control Board may accept, reject, or accept with modifications the change proposal prior to its incorporation into Appendix E. Should this happen, HQ will notify YMPO and ask the project office to reevaluate the TAR based on the Change Control Board modifications to the change proposal for technical adequacy and compliance with the 10 CFR 60 requirements.

Should you need further information, please contact Ram Lahoti at FTS 896-4099.



Stephen H. Kale
Acting Associate Director
Office of Facilities Siting
and Development

cc: R. Stein, RW-30
J. Saltzman, RW-20
M. Frei, RW-22
L. Barrett, RW-40
B. Jackson
D. Siefken

APPENDIX G

TAR Comment Forms

APPENDIX G

TAR Comment Forms

During the conduct of the Design Acceptability Analysis (DAA), the Title I ESF Design was assessed with respect to 282 specific DAA criteria, more than 100 of which resulted in recommendations. The results of this assessment are documented in Appendix I-5, and in Sections 2.3 and 2.5 of this Review Record Memorandum. Examination of the recommendations in Appendix I-5 shows that many are redundant, having been applied to different physical features of the ESF. As observed in Section 2.5, there are approximately 28 unique recommendations summarized from the results of Part 1, Element 3 of the Technical Assessment Review (TAR). (Five of the 28 unique recommendations have been repeated in the summary Section 2.5, where they apply to more than one NRC Concern.) In accordance with the TAR Plan (see Appendix B) the 28 unique recommendations from TAR Part 1, Element 3 are recorded here on TAR Comment Forms, which originate from procedure QMP-02-08, Rev. 0 (Technical Assessment Review).

The primary reason for the redundancy of recommendations in Appendix I-5 can be traced to similarity of treatment of different ESF physical elements in the design. As a result, the same wording could be used for certain DAA criteria associated with different ESF physical features. The recommendations resulting from assessment of such similar criteria tend to be redundant. Additionally, there is similarity in the controls and design features which address the intent of different DAA criteria. These similarities were addressed in TAR Part 1, Element 3 by grouping DAA criteria that were expected to produce similar, or in many cases identical assessments. Note however, that Appendix I-5 contains an assessment form/package for each of the DAA criteria, that is signed by the responsible reviewer.

It is considered to be more efficient and desirable to present the recommendations in a summary fashion, rather than to create a process that will result in the tracking of as many as 80 multiply redundant TAR Comments (based on the total number of recommendations minus the number of summary recommendations). Accordingly, the TAR Comment Forms that are presented in this appendix for TAR Part 1, Element 3 have been prepared using summary recommendations. Note that each summary comment on the forms lists the applicable assessments from Appendix I-5 by DAA Criteria number, and states that resolution of the TAR Comments is expected to involve consideration of the applicable parts of the detailed recommendations from each listed assessment.

Two TAR Comments are also presented in this appendix for TAR Part 1, Element 2, and are included with the summary recommendations from Element 3. These comments pertain to recommendations made with regard to the ESF Subsystem Design Requirements Document (SDRD), as discussed in Section 2.2 above. TAR Comments are also provided for the 17 recommendations resulting from the data reasonableness reviews of TAR Part 1, Element 4 as discussed in Section 2.4.

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-006
11/88

Sheet 1 of 1

Technical Assessment Review Subject TAR Part 1, Element 2 (Assessment of SDRD)

Reviewer M. D. Voegele, Representative of
Subcommittee #1

Organization Lead: M. D. Voegele (SAIC/
T&MSS)

Date February 2, 1989

Comments Resolved By _____

Organization _____

Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	RESOLUTION		Reason	REVIEWER'S DISPOSITION	
			Accept	Reject		Accept	Reject
1.		It is recommended that the DAA criteria developed under Element 2 (see attached RRM Appendix I-3) be considered for inclusion in the revision to the SDRD that is ongoing in preparation for Title-II design activities. Criteria should also be developed for the other Part 60 requirements (discussed in Section 2.6) not addressed by the DAA criteria, i.e., those Part 60 requirements found to be applicable to the ESF but not directly related to NRC Concerns 1, 2, and 3. Additional information relative to the DAA Criteria, and the DAA assessment of the SDRD, is documented in the attached RRM Sections 2.1, 2.2, and 2.5.					
2.		It is recommended that the revised ESF SDRD contain an appendix with a criteria list similar to the list of DAA Criteria in Appendix I-3, but which addresses all of the 46 requirements from Part 60 that are applicable to the ESF. This would facilitate evaluation of how the SDRD criteria reflect the Part 60 requirements.					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-006
11/88

Sheet 1 of 20

Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

Reviewer M. D. Voegele, Representative of
Subcommittee #1

Organization Lead: M.D. Voegele (SAIC/
T&MSS)

Date February 2, 1989

Comments Resolved By _____

Organization _____

Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
1.		<p>The design does not specify excavation techniques for controlling overbreak or limiting rock mass damage during excavation of the main pad, particularly the northwest portion. Controls should be imposed on excavation techniques for pad construction as part of the Title-II design. In particular, the diameter and length of blast holes, and the types of explosives which may be used, should be specified. Also, a Blasting Plan should be required to be submitted for approval by the controlling official at least 4 hours prior to each blast, and a vibration monitoring program should be implemented.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.9.6.1, 1.16.1.1, and 2.7.1.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
2.		<p>The treatment of procedures planned for use in controlling water inflow is marginally adequate in the current Title-I ESF Design description and supporting evaluations. More detail on these requirements, including contingency plans and consideration of borehole packer seals, should be provided in the Title-II ESF Design.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, and 1.12.6.5. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD CONTINUATION SHEET

N-QA-006
11/88

Sheet 2 of 20

Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
3.		<p>The treatment of procedures needed to control the use of water in ESF construction, operation, and testing activities is marginally adequate in the current Title-I ESF Design. More detail on the control of the amount and disposition of water used for such activities as blast hole drilling and cleaning of walls for mapping, should be provided in the Title-II ESF Design. The use of conventional drilling methods (fluid circulation) versus dry drilling methods for the various boreholes to be drilled from the ESF should be evaluated with respect to waste isolation concerns.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to DAA Criterion 1.6.1.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
4.		<p>The water disposal system (specifically the pond and sewer system) should be carefully examined to determine the impact of the planned location on waste isolation. The distance from the planned water disposal areas at the surface to the repository boundary should be evaluated with respect to postclosure performance. The analysis should be done early enough in Title II design to allow a decision to be made regarding whether or not it is necessary to move the pond and sewer system or to line the pond.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, and 1.14.2.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD **CONTINUATION SHEET**

N-QA-006
11/88

Sheet 3 of 20

Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
5.		All detailed testing procedures, particularly for construction phase ESF testing, should be examined with respect to potential impacts on waste isolation performance, and potential for interference between tests.					
6.		<p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.14.8.1, 1.14.8.7, and 2.5.8.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p> <p>Recommendations the of West (1988) report should be addressed in further design work. Procedures should also be established for control of all materials entering or leaving the ESF, particularly related to the limitation of the introduction of hydrocarbons, solvents, and chemicals.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.10.4.4, 1.10.4.5, 1.10.5.4, 1.10.5.5, 1.10.6.5, 1.10.6.6, 1.10.8.1, 1.10.8.2, and 1.10.8.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD CONTINUATION SHEET

N-QA-006
11/88

Sheet 4 of 20

Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
7.		<p>The results of future microbial studies should be evaluated in future design documents, to the extent practicable, to assure there will be no long term adverse effects from the introduction of potential growth substrate materials.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.10.8.2, and 1.10.8.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
8.		<p>Statements in regard to criteria concerning rock-water chemistry and the use of J-13 water for the ESF may need to be reevaluated during the earliest stages of construction (i.e., construction of the shafts and main test level) when additional information on the chemistry of U2 pore water is available.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, and 1.10.8.4. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
9.		<p>Further design analyses should consider the effects of fire involving tests conducted in the underground test areas, on the waste isolation performance of the rock mass. The materials to be used in testing, and the fire protection and suppression systems, should be evaluated with respect to the effects of fire.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, and 1.12.6.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
10.		<p>QA procedures for identifying items important to waste isolation should be developed and implemented early in Title-II ESF Design. Comparative evaluations of alternatives for major design features will be required if the features are found to be important to waste isolation.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.3.4.2, 1.6.1.1, 1.8.6.1, and 1.9.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
11.		<p>Requirements relevant to the drilling and testing of boreholes in proximity to the exploratory shafts, particularly with respect to the multiple purpose borehole (MPBM) activity, should be provided in the Title-II ESF Subsystem Design Requirements Document (SDRD). The Title-II ESF Design should then accommodate this activity as a result of complying with the SDRD.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.2.8.1, 1.6.1.1, 1.8.6.1, and 1.9.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
12.		<p>Analyses planned for Title-II design evaluations should include sensitivity evaluations as appropriate to support reevaluation of compliance with criteria and constraints, and modification of design features, if necessary during construction as variable underground conditions are encountered. Also, sensitivity analyses would reinforce statements about the benefit gained from separating testing and waste emplacement areas.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.2.4.1, 1.2.5.1, 1.6.1.1, and 1.13.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
13.		<p>The alignments and locations of boreholes from the underground portion of the ESF should be monitored during construction, surveyed, and the results included on all underground working maps.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.2.6.3 and 1.6.1.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
14.		<p>Title-II drawings for the ESF, including test areas, should indicate to the extent practicable the extent of boreholes to be drilled from the shafts and drifts, to evaluate compliance with criteria pertaining to penetration of the TSW2 unit and separation of testing from waste emplacement areas. In addition, Title-II drawings should show the entire layout of the main test level, the location and extent of each existing or planned surface-based borehole that penetrates the repository horizon, and the standoff distance required.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.2.6.1, 1.2.8.2, 1.6.1.1, 1.8.6.1, and 1.9.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title 1 Design

G-10

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
15.		<p>The 15 m drift-borehole standoff criterion should be interpreted with respect to the MPBH's and borehole USW G-4. Closer proximity of openings to these boreholes may be desirable, and exceptions to the standoff criterion should be considered. Special consideration should be given to the localized drainage within the designated test area, the manner in which the MPBH's minimally penetrate the repository horizon, and the proximity of the MPBH's to the much larger shaft and connecting drift openings.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.2.6.2, 1.6.1.1, and 1.11.6.5. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					
16.		<p>The two-diameter separation criterion for adjacent drifts should be evaluated to assess whether it should apply to short drifts and alcoves, and ESR tests such as the Sequential Drift Mining, Waste Package Vertical, and Heated Room tests. The ESR layout should then be changed, if necessary, to comply with the criterion.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.6.1.1, 1.11.6.6, 1.15.6.3, and 2.6.6.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
17.		<p>The location of the Waste Package Vertical test should be reevaluated to ensure that sufficient separation exists between the test drifts and the proposed repository.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 2.4.6.1, 2.6.6.3. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
18.		<p>Construction specifications should be developed for the Title-II ESF Design to indicate where pressure grouting during construction is to be avoided, and to reflect compliance with specific, applicable criteria that pertain to such grouting.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.4.4.2, and 1.4.5.2. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
19.		<p>The impact of repository thermal loading on the ES liners should be evaluated, and the analysis should be included in the Title-II design. The recommended analyses can be at least partially accomplished by post-processing of results from published analyses.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.18.4.1, and 1.18.5.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
20.		<p>A three-dimensional thermomechanical analysis of the ESF should be performed for the Title-II design. The analysis should cover time-steps up to 10,000 years after waste emplacement. This analysis should evaluate the extent and nature of changes in the hydrologic conditions around the ESF resulting from thermal and thermomechanical effects of the repository.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.6.1.1, 1.9.6.1, and 1.10.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
21.		<p>Maintain the capability to extend ES-1 into the Calico Hills unit, if it is deemed necessary and prudent. Include specific criteria should be provided in the body of the Title-II SDRD to address the flexibility requirement, if appropriate. Prepare a risk-benefit analysis early in Title-II ESF Design if possible, providing analyses as described in SCP Section 8.4.2.1.6.1.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 1.1.1.1, 1.2.4.1, 1.3.4.1, 1.6.1.1, and 2.4.4.2. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
22.		<p>The pillar between the repository and the southeast margin of the ESF main test level layout should be increased to at least twice the diameter of the larger drift, i.e., to at least 40 feet.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 2.7.6.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS		RESOLUTION			REVIEWER'S DISPOSITION		
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
23.		<p>Work in progress should be completed in association with the Title-II ESF Design, to establish a basis for determining the controls on water and blasting methods that are needed to limit test-test interference and construction-test interference, and maintain the ability to characterize the site.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 2.5.4.1, 2.5.5.1, 2.5.6.1, 2.5.6.4, and 2.5.8.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
24.		<p>The requirements developed in Title-II should contain specific constraints, where appropriate, on the types of tracers added to water used for construction, testing and operations.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 2.5.6.6. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
25.		<p>A formalized methodology should be developed for identifying and implementing testing activities that support performance confirmation as required in 10 CFR 60 Subpart F, in particular for obtaining appropriate baseline data relative to the ESF (surface) site including the main pad and underlying bedrock.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 2.8.1.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
26.		<p>Document the nature of the present uncertainty in projected depths to the ES-1 and ES-2 MTL breakouts, define the sensitivity and/or required accuracy of the MTL horizon selection, and state what information will be used for breakout selection in ES-1 and ES-2. Plans for certain contingencies, such as failure of the MPBH's to penetrate to the repository horizon, should be addressed.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 3.1.4.2 and 3.1.5.2. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
27.	4	<p>Develop a reference description for the location, alignment, and extent of boreholes in the ESP. Compilation is especially appropriate for boreholes located near potential waste emplacement areas, or which may penetrate an intervening pillar. The description is needed to show that waste isolation concerns relative to these boreholes can be met while obtaining needed information for site characterization.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 3.3.8.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Technical Assessment Review Subject TAR Part 1, Element 3, Assessment of Adequacy of ESF Title I Design

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
28.		<p>Develop test location acceptance criteria for planned ESF tests during Title-II ESF Design. If operative criteria are developed, they will tend to show that the respective tests will produce representative data in the context of the strategy presented in SCP Section 8.4.2.1.5. Test location criteria are likely to affect the ESF design, particularly the sequence of drifting and the MTL layout.</p> <p>(Additional information on the basis for this comment is documented in the portions of the attached Appendix I-5, corresponding to the following DAA Criteria: 3.5.4.1, 3.5.5.1, 3.5.6.1, and 3.5.7.1. The foregoing text summarizes aspects of the recommendations for these DAA Criteria. It is expected that resolution of this TAR comment will address the applicable parts of the detailed recommendations from the attached material.)</p>					

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Sheet 1 of 2

Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer JOE TILKERSON Organization SNL Date 2/1/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
1		<p>The reviewer of the Costin and Bauer (1988) report, titled "Preliminary Analysis of the Excavation Investigation Experiments Proposed for the Exploratory Shaft at Yucca Mountain, Nevada Test Site," recommends that specific parameters be added to the RIB for use in Title II design: (1) concrete properties for materials used in the liner; (2) in situ stress as a function of depth; and (3) properties of the materials planned for use in support systems proposed for the ESF.</p> <p>In the review of the Reference Information Base (RIB) Version 03.001, the reviewers found that, in general, the parameters values in the RIB were reasonable for simulating the behavior of the ESF at Yucca Mountain for Title I design. However, it was recommended that in future versions of the RIB values for hydrologic parameters should be included and that the seismic design value for the ESF liner be based on a peak ground acceleration of 0.3g.</p>					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(3)		In the review of Hill (1985), titled "Structural Analysis of the NEMSI Exploratory Shaft," it was noted that a value used for the Young's Modulus was inappropriate for use for a rock mass value (more appropriate for a matrix value), however the reviewer states that it is unlikely that the value used would significantly impact the predicted stresses and related factors of safety. The reviewer recommends that authors using this report in future evaluations should indicate recognition of the fact that a rock matrix value was used in the simulations for the elastic modulus.					

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Technical Assessment Review Subject TAK PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer CHARLES VOSS Organization Battelle PNL Date 2/3/88

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		It was recommended that the objectives and use of the analyses in Appendix B.2 of the ESP Title I Design Summary Report, Vol. 4B, "Preliminary Evaluation: Three Dimensional Far-Field Analysis for the Exploratory Shaft Facility," be expanded if they are to be used in Title II design.					
②		In the report by Case and Kelsall, (1987) titled "Modification of Rock Mass Permeability in the Zone Surrounding a Shaft in Fractured, Welded Tuff," the reviewer discovered that the SCP discussion concerning preferential pathways was inconsistent in its treatment of faults intersecting the exploratory shaft. The case where a fault is intersected and identified as such is not considered. The reviewer recommends that a construction scenario should be considered: if or when the exploratory shaft intersects a fault extending to the repository area, the fault should be evaluated and the results provided in subsequent SCP Progress Reports. In addition, the appropriateness of including a discussion on the feasibility of sealing such a fault and the criteria for doing so should also be considered.					

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Technical Assessment Review Subject TAK PART I ELEMENT 4 DATA APPROPRIATENESS

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(3)		<p>The review of the Ehgartner (1987) report, titled "Sensitivity Analysis of Underground Drift Temperature, Stresses, and Safety Factors to Variation on the Rock Mass Properties of Tuff for a Nuclear Waste Repository Located at Yucca Mountain," notes that SCP Section 8.4.3.2.3.1 appears to mistake the results of the analyses. The SCP reports that changes in rock strength and modulus in the Topopah Spring had a greater effect on factors of safety than other parameters, but in no case was failure of the rock mass predicted. Ehgartner reports that approximately 20% of the possible values for the thermal and thermal/mechanical properties result in rock mass safety factors of less than unity. The reviewer recommends that the authors of SCP Section 8.4.3.3 document the extent that the Ehgartner (1987) reference was used to reach conclusions concerning the potential impacts of site characterization activities on the performance objectives for the site. An assessment should be made by the author(s) whether the conclusions reached in 8.4.3.3 are changed in any way as a result of this information.</p>					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(4)		<p>The reviewer noted that the two citations in the text of the SCP are incorrect for the St. John (1987) reports, titled "Reference Thermal and Thermal/Mechanical Analyses of Drifts for Vertical and Horizontal Emplacement of Nuclear Waste in a Repository in Tuff" and "Thermomechanical Analysis of Underground Excavations in the Vicinity of a Nuclear Waste Isolation Panel." It is recommended that these be corrected either in an errata sheet or in SCP Progress Reports.</p>					
(5)		<p>In the review of the St. John and Mitchell (1987) report, titled "Investigation of Excavation Stability in a Finite Repository," the reviewer noted some potentially important data that were not used in SCP section 8.4. The authors note that the joint activation around the access drifts due to both thermomechanical and excavation-induced stresses is very sensitive to joint orientation. Because joint dislocation can alter the hydrologic properties of the rock, the reviewer suggests that the thermomechanical investigations be revisited with estimates of joint activation.</p>					
6		<p>The reviewer of "Technical Letter Memorandum RSI(ALO)-0037" recommends that the objectives of the report and the use of information contained within should be clarified if the report is to be used in Title II design.</p>					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROXIMATIONS

Reviewer PAUL CLOKE

Organization SAIC / LV

Date 2/3/89

Comments Resolved By _____

Organization _____

Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		<p>The review of Birgersson and Neretnieks (1982) titled "Diffusion in the Matrix of Granitic Rock," indicates that the report was inappropriately used to support limited diffusion of the geochemical alteration zone caused by grout emplaced in the ESP. The reviewer suggests progress reports for the SCP reference the proper document and that alteration due to diffusion from emplacement of grout be re-evaluated prior to emplacing grout in or within 30 meters of test areas.</p>					

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Technical Assessment Review Subject DATA APPROPRIATENESS

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
2		<p>A reviewer of the West (1988) report, titled "MMSI ESP Fluids and Materials Evaluation," does supply a list of recommendations. These recommendations should be evaluated for their impact upon Title II design. 1) The recommendations on pages 40-41 of West (1988) should be followed, if they are not already implemented. 2) Plans for chlorinating J-13 water at the well should be changed. All chemicals added should be reviewed carefully for potential impact on the repository before being used. 3) Differences in rationale between this review and the report should be reconciled, and, if this results in any differences in the rationale deemed appropriate for support of the conclusions drawn, the revised logic should be formally documented. 4) During site characterization, data should be measured to replace the estimates made in the report and the impact, if any, on the conclusions evaluated. This may in turn dictate repository design changes. 5) The designers of the ESP, H&N and F&S, should review Table A-1 in West (1988) carefully to determine whether there will be any other materials used that are not already identified. 6) All materials that will enter the repository that have not already been evaluated should be subjected to the same process as described in West (1988). Additionally, a test should be done prior to the start of ESP in situ testing to determine the amount of penetration of hydrocarbons into the rock.</p>					

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Technical Assessment Review Subject TAK PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer SANDRA DOTY Organization SAIC / GOLDEN Date 2/3/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		<p>A reviewer of the report by West (1988), titled "MMSI ESF Fluids and Materials Evaluation," proposed three principal concerns. The first was that the author did not appear to use conservative values for the percentage of drilling fluid that is expected to be lost to the surroundings. Values as high as 70% may be more appropriate than the 10% used in the report. The report recommends that minimal-water techniques should be used in the excavation of any underground opening that falls within a spherical radius of 300 ft from the center of the bulk permeability room test. The reviewer recommends that minimal-water techniques should be used throughout the main level since four locations are planned for the bulk permeability test, and the exact locations are unknown. Finally, the report concludes that hydrocarbons and solvents would only be expected to penetrate a few centimeters, however, this conclusion does not take into account the potential that the fracture system may allow considerably greater penetration.</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-006
11/88

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer RICHARD LEE Organization SAIC/LV Date 2/3/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
<u>1</u>		<p>The Nimick et al. (1988) report, titled "Preliminary Evaluation of the Exploratory Shaft Representativeness for the Yucca Mountain Project," evaluates representativeness of a variety of parameters that were at issue in the evaluation of the ESF preliminary location. The authors use a very general definition of "representative" for the description of the expected stratigraphic unit thickness, lithophysal abundance, etc. It appears that this broad definition does not appear with the citation in section 8.4 of the SCP, and consequently the "representative" attributes of specific parameters may have been overstated.</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-006
11/88

Sheet 1 of 1

Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer JOE PRIZIO Organization USBR Date 2/3/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(1)		A reviewer of the Fernandez et al. (1988) report suggests that shaft-inflow calculations for the flood-inundation scenario should include the effects of potential earth movement at the new ES locations; or, alternatively, the SCP should cite previous studies that include potential topographical changes affecting shaft inflow at the old ES locations as an upper bound case. In addition, the reviewer notes that the report how precipitate formation may affect ESP drainage capabilities, while no similar discussion appears in the SCP. Also, the SCP discussed how the separate issue of siltation might affect ESP drainage, while no corroborating discussion appear in the report.					

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Technical Assessment Review Subject TAR PART ELEMENT 4 DATA APPROPRIATENESS
 Reviewer ROD TRAUTZ Organization USGS Date 2/3/89
 Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		In the Fernandez et al. (1988) report, titled the "Review of Selected Analyses to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain," the third reviewer recommended that additional calculations be done using higher values of the draft pressure. The reviewer speculates that because the effects of gas compressibility and water vapor transport were not included in the calculation, an overestimate the pneumatic conductivity resulted.					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer ERNEST HARDIN Organization SAIC Date 2/3, 9

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(1)		In the review of the Bertram (1984) report (see also Chapter 3 of this TAR), titled "NANWSI Exploratory Shaft Site and Construction Method Recommendation Report," the reviewer notes that the methodology used to select potential sites did not consider potential impacts on waste isolation performance.					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer EDWARD KWICKUS Organization USGS Date 2/3/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		In the report by Bodvarsson et al. (1988), titled "Preliminary Calculations of the Effects of Air and Liquid Water-Drilling on Moisture Conditions in Unsaturated Rocks," the reviewer does express disagreement with a conclusion drawn in the SCP based on the material presented in Bodvarsson et al. and other reports. The reviewer notes that it is unclear whether re-equilibration time will be longer or shorter for non-welded tuff than for welded should they be exposed to moisture. The reviewer also notes that numerical simulations did not consider certain factors that may result in interference. It is recommended that the considerations voiced by the reviewer should be evaluated to ascertain whether or not they have been considered previously and if not they should be evaluated in the Title II design.					

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Technical Assessment Review Subject TAR PART I ELEMENT 4 DATA APPROPRIATENESS

Reviewer CLIFFORD NOBONHA

Organization WESTON

Date 2/3/89

Comments Resolved By _____

Organization _____

Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
(1)		A reviewer of the Peters et al. (1986) report, titled "The Effect of Percolation Rate on Water-Travel Time in Deep, Partially Saturated Zones," noted that the values used for the compressibility of water was off by about a factor of four. The reviewer notes that this error is irrelevant for the unsaturated zone.					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

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Sheet 1 of 1

Technical Assessment Review Subject TAR PART I: ELEMENT 4 DATA APPROPRIATENESS

Reviewer KEITH KERSCH

Organization SAIC LV

Date 2/3/89

Comments Resolved By _____

Organization _____

Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		<p>In the Peterson et al. (1988) report, titled "Technical Correspondence in Support of the Hydrologic Effects of Exploratory Shaft Facility Construction at Yucca Mountain," the reviewer does not disagree with the analytic methods or with the conclusion drawn. However, the reviewer does note several instances where the data used appear to be inappropriate and one instance where he does not feel qualified to assess the data value. It is recommended that the appropriateness of the rock and rock fracture compressibility values be re-evaluated.</p>					

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

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Sheet 1 of 1

Technical Assessment Review Subject TAR PART I ELEMENT 4, DATA APPROPRIATENESS

Reviewer AUGUST C. MATTHUSEN Organization SAIC/LV Date 2/3/89

Comments Resolved By _____ Organization _____ Date _____

REVIEWER'S COMMENTS

RESOLUTION

REVIEWER'S DISPOSITION

Item Number	Document Identification	Comments	Accept	Reject	Reason	Accept	Reject
①		<p>There were two reports that appear to require further consideration for data uncertainty: Buscheck and Nitao, 1988; and Peters Memo 3, 1988. It is recommended that if the material in these reports is used significantly in Title II Design, then further assessments should be conducted with data uncertainty considered.</p>					

APPENDIX H

**List of Reviewers
by Name, Organization, and Discipline**

TAR PARTICIPANTS--ESF TITLE-I DAA & CE

<u>Last Name</u>	<u>First Name</u>	<u>Function</u>	<u>Organization</u>	<u>Committees</u>
Bentley	Craig B.	Hydrologist	USGS	3
Bingham	Felton	Perf. Assess. & Regulatory Specialist	SNL	3
Cady	Ralph C.	Hydrologist	DOE/HQ	1 & 2
Cloke	Paul L.	Geochemist	SAIC	1 & 2
Costin	Laurence S.	Geotechnical Engineer	SNL	1
Crowe	Bruce M.	Geochemist	LANL	1
Doty	Sandra G.	Mining & Geotechnical Engineer	SAIC-Golden	2 & 3
Girdley	W. Arch	Geologist	DOE/YMPO	1
Hardin	Ernest L.	TAR Tech. Specialist, Geophysicist	SAIC	1 & 2
Jardine	John	TAR Q.A. Specialist	SAIC	
Kersch	Keith M.	Hydrogeologist	SAIC	1 & 2
Kimball	Jeffrey K.	Geophysicist, Reg. & P.A. Specialist	DOE/HQ	3
King	Jerry L.	TAR Chairman	SAIC	
Kwicklis	Edward M.	Hydrologist/Hydrogeologist	USGS	2
Lee	Richard C.	TAR Secretary, Geophysicist	SAIC	2
Levich	Robert A.	YMPO Branch Chief	DOE/YMPO	
Lugo	Miguel	Regulatory Specialist	Weston	1
Marvil	Joshua	Hydrologist/Hydrogeologist	SAIC-Golden	2 & 3
Matthusen	August C.	Subcommittee Lead & Geologist	SAIC	2
Noronha	Clifford J.	P. A. Specialist, Hydrogeologist	Weston	2
Prizio	Joseph V.	Geotechnical Engineer	Bureau of Rec	2 & 3
Ross-Brown	Dermot M.	Mining Engineer	SAIC-Columbus	1
Sinnock	Scott	Subcomm. Lead, P. A. & Reg. Specialist, Geologist	SNL	3
Tillerson	Joe R.	P. A. Specialist, Geotech. Engineer	SNL	1 & 2
Trautz	Robert C.	Hydrologist/Hydrogeologist	USGS	2 & 3
Van Camp	Scott	Geologist	Weston	3

TAR PARTICIPANTS--ESF TITLE-I DAA & CE

<u>Last Name</u>	<u>First Name</u>	<u>Function</u>	<u>Organization</u>	<u>Committees</u>
Voegelé	Michael D.	Subcomm. Lead, Geotech.Engr. & P. A. Specialist	SAIC	1
Voss	Charles F.	Mining & Geotech. Engineer, P.A. Specialist	PNL	1 & 2
Wilson	William E.	Hydrologist/Hydrogeologist	USGS	3

APPENDIX I

Supporting Documentation for Design Acceptability Analysis

APPENDIX I-1

**Association of SDRD Functional Requirements with
Relevant 10 CFR Part 60 Requirements**

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 1 of 11)

NOTE: This table associates Functional Requirements from the ESF SDRD (12/87) with requirements from 10 CFR 60 that were identified in the DAA as applicable to the ESF. This is not intended to imply that the listed requirements from 10 CFR 60 are adequately addressed by the ESF SDRD

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.15(b) Unless the Commission determines with respect to the site described in the application that it is not necessary, site characterization shall include a program of in situ exploration and testing at the depths that wastes would be emplaced	3	Sec. 1.2.6.0, FR 1
	3	Sec. 1.2.6.4, FR 1
	3	ECR No. 21
	3	Sec. 1.2.6.6, FR 1
		Support in situ site characterization for the Mined Geologic Disposal System and provide testing facilities in situ site characterization as required by DOE/OGR milestones and the Site Characterization Plan
		Provide safe access between the ESF surface and the underground portion of the ESF to meet the needs of underground site characterization testing (at three levels) ^c
		...(change) "three levels" to "two levels... The flexibility to sink shafts in the Calico Hills will be maintained."
		Provide underground openings in welded and nonwelded tuff for in situ site characterization construction, operations, and maintenance

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 2 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.15(b) (continued)	3	Sec. 1.2.6.6.2, FR 1 The test areas shall provide excavated spaced of adequate size and appropriate opening geometry to conduct the necessary underground site characterization test activities
60.15(d)(1): Investigations to obtain the required information shall be conducted in such a manner as to limit adverse effects on the long term performance of the geologic repository to the extent practicable.	1	Sec. 1.2.6.0, FR 6 Provide design and construction methods that will demonstrate licensability and constructability for the candidate repository
60.15(d)(2) The number of exploratory boreholes and shafts shall be limited to the extent practical consistent with obtaining the information needed for site characterization	3	None applicable

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 3 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.15(d)(3) To the extent practical, exploratory boreholes and shafts in the geologic repository operations area shall be located where shafts are planned for underground facility construction and operation or where large unexcavated pillars are planned.	1	Sec. 1.2.6.0, FR 2 Provide an ESF whose permanent items can be incorporated into the repository and which can be used to support phase I repository construction. Those items, listed below, are the ESF permanent systems, structures, and components that shall be designed, procured, and constructed to be incorporated into the repository... The permanent items must be designed to have a maintainable life and quality as specified for the repository
	3	None applicable
60.21(c)(1)(ii)(D) The effectiveness of engineered and natural barriers, including barriers that may not be themselves a part of the geologic repository operations area, against the release of radioactive material to the environment. The analysis shall also include a comparative evaluation of alternatives to the major design features that are important to waste isolation, with particular attention to the alternatives that would provide longer radionuclide containment and isolation.	1	None applicable

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 4 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.21(c)(11) A description of design consideration that are intended to facilitate permanent closure and decontamination or dismantlement of surface facilities.	1	None applicable
60.74 (a) DOE shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part. These may include tests of: (1) Radioactive waste, (2) the geologic repository including its structures, systems, and components, (3) radiation detection and monitoring instruments, and (4) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste. (b) The tests required under this section shall include a performance confirmation program carried out in accordance with Subpart F of this part.	1 2, 3 2,3 2,3	None applicable ^d Sec. 1.2.6.6, FR 1 Sec. 1.2.6.6.2, FR 1 Sec. 1.2.6.8, FR
		Provide underground openings in welded and nonwelded tuff for in situ site characterization construction, operations, and maintenance The test areas shall provide excavated space of adequate size and appropriate opening geometry to conduct the necessary underground site characterization test activities The underground tests shall provide the means for the implementation of site characterization testing plans and provide data to support performance confirmation testing

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 5 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.112 The geologic setting shall be selected and the engineered barrier system and the shafts, boreholes and their seals shall be designed to assure that releases of radioactive materials to the accessible environment following permanent closure conform to such generally applicable environmental standards for radioactivity as may have been established by the Environmental Protection Agency with respect to both anticipated processes and events and unanticipated processes and events.	1	None applicable ^d
60.113(a)(1)(i): The engineered barrier system shall be designed so that, assuming anticipated processes and events: (A) Containment of HLW will be substantially complete during the period when radiation and thermal conditions in the engineered barrier system are dominated by fission product decay; and (B) any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times.	1	None applicable ^d

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 6 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.113(a)(1)(ii)(A): Containment of HLW within the waste packages will be substantially complete for a period determined by the commission taking into account the factors specified in 60.113 (b) provided that such period shall not be less than 300 years nor more than 1000 years after the permanent closure of the repository.	1	None applicable ^d
60.113(a)(1)(ii)(B): The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1000 years following permanent closure.	1	None applicable ^d

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 7 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.130: Sections 60.131 through 60.134 specify minimum criteria for the design of the geologic repository operations area. These design criteria are not intended to be exhaustive, however. Omissions in §§ 60.131 through 60.134 do not relieve DOE from any obligation to provide such safety features in a specific facility needed to achieve the performance objectives. All design bases must be consistent with the results of site characterization activities	1	None applicable ^d
60.133(a)(1) The orientation, geometry, layout, and depth of the underground facility, and the design of any engineered barriers that are part of the underground facility shall contribute to the containment and isolation of radionuclides	1	Sec. 1.2.6.6, FR 2 Provide compatibility with the repository conceptual design so that the test level development does not adversely impact future repository development
60.133(a)(2) The underground facility shall be designed so that the effects of credible disruptive events during the period of operations, such as flooding, fires and explosions, will not spread through the facility	1, 2	Sec. 1.2.6.2.2, FR 1 The water supply, storage, and distribution system shall provide the potable, fire protection, and process water throughout the ESF during construction and operations of the ESF

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 8 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.133(a)(2) (continued)	1, 2	Sec. 1.2.6.7.5, FR 1 The water distribution system shall meet the needs of fire protection, construction, and operational requirements
	1, 2	Sec. 1.2.6.7.8, FR 1 The fire protection system shall be provided for the electronic fire detection, warning, and suppression of fires in the ESF underground
	1, 2	Sec. 1.2.6.7.11, FR 1 ...The central surface control room for the monitoring of the underground systems shall provide a central location for facility instrument readouts, alarms, equipment status, and automatic and/or manual override equipment controls...
60.133(b) The underground facility shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions identified through in situ monitoring, testing, or excavation	1, 3	None applicable ^d
	2	Sec. 1.2.6.1, FR 3 The surface layout (site plan) must accommodate future expansion as determined by the uncertainty allowance (see Section 1.2.6.0, Performance Criteria item #2.)
	2	Sec. 1.2.6.4, FR 1 Provide safe access between the ESF surface and the underground portion of the ESF to meet the needs of underground site characterization testing (at three levels)
	2	Sec. 1.2.6.7, FR 3 Provide for the distribution of utilities around the operations area of the Main Test Level in such a manner to allow for flexibility in the siting and construction of the final testing locations

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 9 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.133(d) The design of the underground facility shall provide for control of water or gas intrusion	2	Sec. 1.2.6.2.5, FR 1 The mine wastewater system shall collect and dispose of liquid non-sanitary wastes generated in the ESF during construction and operations. The mine wastewater collection system shall discharge to a wastewater pond located a minimum of 400 feet beyond the perimeter of the proposed repository subsurface facility to prevent interference with the site characterization activities. This pond may be co-located with the muck storage facilities if all other conditions are favorable
	1, 2	Sec. 1.2.6.4, FR 3 Provide for water drainage and/or control in the shaft.
	1, 2	Sec. 1.2.6.5, FR 2 Provide for water drainage and/or control in the shaft.
	1, 2	Sec. 1.2.6.7.6, FR 1 The mine wastewater collection system shall provide for groundwater control, handling, drainage, collection, treatment (as required), and transfer to the surface from the shafts and underground facilities
60.133(e)(2) Openings in the underground facility shall be designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock	1, 2	None applicable ^d

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 10 of 11)

Section of 10 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.133(f) The design of the underground facility shall incorporate excavation methods that will limit the potential for creating a preferential pathway for groundwater to contact the waste packages or radionuclide migration to the accessible environment	1	Sec. 1.2.6.0, FR 6
	2	None applicable ^d
60.133(h) Engineered barriers. Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure	1	None applicable ^d
60.133(i) The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response of the host rock, and surrounding strata, groundwater system	1	None applicable ^d
60.137 The geologic repository operations area shall be designed so as to permit implementation of a performance confirmation program that meets the requirements of Subpart F of this part	2	Sec. 1.2.6.8, FR 1
		The underground tests shall provide the means for the implementation of site characterization testing plans and provide data to support performance confirmation testing

Table I-1. Association of SDRD Functional Requirements with Relevant 10 CFR Part 60 Requirements
(Page 11 of 11)

Section of 11 CFR 60	NRC Concern ^a	SDRD Reference ^b
60.140(d): The program shall be implemented so that: (1) it does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives	1	None applicable ^d

^aNRC concerns 1, 2 and 3 taken from TAR Plan

^bFR = Functional Requirement; ECR = Engineering Change Request.

^cSubsequently modified by Engineering Change Request.

^dOther SDRD content such as Performance Criteria, Constraints, and Assumptions does apply to this regulation.

APPENDIX I-2

**Association of Supplemental SDRD Information with
Relevant 10 CFR Part 60 Requirements**

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 1 of 28)

NOTE: This table associated Performance Criterion, Constraint, and Assumption from the ESF SDRD (12/87) with requirements from 10 CFR 60 that were identified in the DAA as applicable to the ESF. This is not intended to imply that the listed requirements from 10 CFR 60 are adequately addressed by the ESF SDRD.

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.15(b) Unless the Commission determines with respect to the site described in the application that it is not necessary, site characterization shall include a program of in situ exploration and testing at the depths that wastes would be emplaced	3	Sec. 1.2.6.0, PC 1
	3	Sec. 1.2.6.6, PC 7
	3	Sec. 1.2.6.6, C 2
60.15(d) (1): Investigations to obtain the required information shall be conducted in such a manner as to limit adverse effects on the long term performance of the geologic repository to the extent practicable.	1	Sec. 1.2.6.0, PC 10

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 2 of 28)

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.15(d) (1) (continued)	1	Sec. 1.2.6.1, C 1 The design and construction of the site (civil improvements) for the permanent ESF structures, systems, and components shall not significantly increase the preferential pathways for groundwater or radioactive waste migration to the accessible environment
	1	Sec. 1.2.6.1, C 10 The designs for site preparation shall ensure that construction activities disturb only the minimum amount of land necessary to accomplish the project
	1	Sec. 1.2.6.8, PC 1 In situ site characterization shall meet applicable requirements of 10 CFR Part 60 and 10 CFR Part 960
60.15(d) (2) The number of exploratory boreholes and shafts shall be limited to the extent practical consistent with obtaining the information needed for site characterization.	3	Sec. 1.2.6.4, PC 9 Sec. 1.2.6.5, PC 10 Various portions
60.21(c) (11) A description of design consideration that are intended to facilitate permanent closure and decontamination or dismantlement of surface facilities.	1	Sec. 1.2.6.0, C 10 The ESF shall be designed, constructed, and operated to meet decommissioning and closure requirements of applicable federal, state, and local codes

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 3 of 28)

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.21(c) (11) (continued)	1	Sec. 1.2.6.9, PC 1 The ESF shall be designed, constructed, and operated to meet decommissioning and closure requirements of applicable federal, state, and local codes
	1	Sec. 1.2.6.9, C 1 The ESF and repository designs shall be integrated to ensure that decommissioning and closure requirements are consistent
	1	Sec. 1.2.6.9.2, C 2 Facilities shall be removed by the most practical and cost-effective methods. (a) Horizontal and vertical drillholes extending from the exploratory shaft(s) and rooms will be sealed. (b) Subsurface drifts and rooms shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (c) Shafts(s) shall be stripped of equipment and structures. (d) Shaft liners may be left in place. (e) Shaft(s) shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material
60.74 (a) DOE shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the	2,3	Sec. 1.2.6.0, PC 2 Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 4 of 28)

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.74 (continued)		
administration of the regulations in this part. These may include tests of: (1) Radioactive waste, (2) the geologic repository including its structures, systems, and components, (3) radiation detection and monitoring instruments, and (4) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste. (b) The tests required under this section shall include a performance confirmation program carried out in accordance with Subpart F of this part.	2	Sec. 1.2.6.4.5, PC 2
	2	Sec. 1.2.6.6, PC 17
		planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance...
		The hoisting conveyance shall be designed to permit the inspection of shaft performance monitoring instrumentation, as well as other shaft inspection and maintenance activities
		The size and layout of the openings excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (see Section 1.2.6.0, Performance Criteria item #2.)

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 5 of 28)

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.74 (continued)	2	Sec. 1.2.6.6, PC 19 During in situ site characterization testing, facilities shall be provided for at least 10 visitors underground at any one time
	2	Sec. 1.2.6.6.2, PC 2 ESF structures, systems, components, and operations must accommodate additional tests and monitoring if required (see Section 1.2.6.0, Performance Criteria item #2.)
	2	Sec. 1.2.6.7.10, PC 1 Sanitary facilities shall be provided to accommodate the collection of wastes from a maximum occupancy of 80 people working underground per shift
	1	Sec. 1.2.6.8, PC 10 Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F
60.112 The geologic setting shall be selected and the engineered barrier system and the shafts, boreholes and their seals shall be designed to assure that releases of radioactive materials to the accessible environment following permanent closure conform to such generally applicable	1	Sec. 1.2.6.0, PC 10 ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application.

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
(Page 6 of 28)

Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.112 (continued)		
environmental standards for radioactivity as may have been established by the Environmental Protection Agency with respect to both anticipated processes and events and unanticipated processes and events.		Sec. 1.2.6.8, C 2 Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112
60.113(a) (1) (i): The engineered barrier system shall be designed so that, assuming anticipated processes and events: (A) Containment of HLW will be substantially complete during the period when radiation and thermal conditions in the engineered barrier system are dominated by fission product decay; and (B) any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times.	1	Sec. 1.2.6.0, PC 10 ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (Applied to portion of the ESF that may become part of the U/G facility.)
	1	Sec. 1.2.6.0, C 3 The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.113(a)(1)(ii)(A): Containment of HLW within the waste packages will be substantially complete for a period determined by the commission taking into account the factors specified in 60.113 (b) provided that such period shall not be less than 300 years nor more than 1000 years after the permanent closure of the repository.	1	Sec. 1.2.6.0, PC 10
	1	Sec. 1.2.6.0, C 3
60.113(a)(1)(ii)(B): The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1000 years following permanent closure.	1	Sec. 1.2.6.0, PC 10

ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (Applied to portions of the ESF that may become part of the U/G facility)

The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment

ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b	
60.113(a) (1) (ii) (B): (continued)	1	Sec. 1.2.6.0, C 3	The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment
60.130: Sections 60.131 through 60.134 specify minimum criteria for the design of the geologic repository operations area. These design criteria are not intended to be exhaustive, however. Omissions in §§ 60.131 through 60.134 do not relieve DOE from any obligation to provide such safety features in a specific facility needed to achieve the performance objectives. All design bases must be consistent with the results of site characterization activities	2	Sec. 1.2.6.4, C 4	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected
	1	Sec. 1.2.6.4, C 13	Shaft permanent structures shall be designed and constructed to withstand the effects of the seismic events as defined in the RIB
	1	Sec. 1.2.6.4, C 5	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration
	2	Sec. 1.2.6.5, C 4	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected
	1	Sec. 1.2.6.5, C 5	Rock support and other structural anchoring materials shall be compatible with waste isolation and

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.130 (continued)		shall neither interfere with radionuclide containment nor enhance radionuclide migration
	1 Sec. 1.2.6.5, C 14	Shaft permanent structures shall be designed and constructed to accommo- date seismic events as defined in the RIB
	1 Sec. 1.2.6.6, PC 4	Rock support and other structural anchoring materials used in rock support systems shall be compatible with waste isolation operations and shall neither interfere with radio- nuclide containment nor enhance radionuclide migration
	2 Sec. 1.2.6.6, PC 24	The chemical content of the blasting agents and explosives shall be con- trolled to preclude adverse effects on insitu site characterization
	2 Sec. 1.2.6.7.8, C 1	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program
	1, 2 ECR No. 12	(Adopt special report entitled: "Exploratory Shaft Seismic Design Basis" as design criteria for the ESF.)

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(a) (1) The orientation, geometry, layout, and depth of the underground facility, and the design of any engineered barriers that are part of the underground facility shall contribute to the containment and isolation of radionuclides	1	Sec. 1.2.6.0, C 3 The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment
60.133(a) (2) The underground facility shall be designed so that the effects of credible disruptive events during the period of operations, such as flooding, fires and explosions, will not spread through the facility	1, 2	Sec. 1.2.6.0, C 2 The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility
	1	Sec. 1.2.6.0, C 7 To the extent practicable, the ESF shall be designed to incorporate the use of noncombustible and heat-resistant materials
	1	Sec. 1.2.6.1.1, PC 1 The main pad shall be designed to handle potential runoff in the existing natural drainage channels from a probable maximum flood
	1, 2	Sec. 1.2.6.7.5, PC 1 The underground water supply and distribution systems shall be adequately sized with sufficient capacity to supply and distribute the water necessary for fire protection, and process water throughout the ESF in accordance with all anticipated needs and services for the construction and operation of the ESF

Table I-2. Association of Supplemental SDRD Information with Relevant 10 CFR Part 60 Requirements
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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(a) (2) (continued)	1, 2	Sec. 1.2.6.7.5, PC 2 The underground system shall have the capability to meet the needs of fire protection during construction and operations under routine emergency and maximum credible firewater demand conditions
	1, 2	Sec. 1.2.6.7.6, PC 3 The mine wastewater system shall have full operating redundancy, or storage capacity to allow installation of spares
	1, 2	Sec. 1.2.6.7.6, PC 7 The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM
	1, 2	Sec. 1.2.6.7.8, PC 1 The fire suppression system shall have the capability to be operated automatically and/or manually
	1, 2	Sec. 1.2.6.7.8, PC 2 Portable extinguishers shall be located in the subsurface areas
	1, 2	Sec. 1.2.6.7.8, C 2 As a minimum, fire hose outlets shall be located at all shaft stations

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(b) The underground facility shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions identified through in situ monitoring, testing, or excavation	2	Sec. 1.2.6.0, PC 2 Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for any the impact associated with this uncertainty allowance...
	2	Sec. 1.2.6.1.2, C 4 The auxiliary pad design and construction shall ensure considerations for expansion (uncertainty allowance).
	2	Sec. 1.2.6.3.1, C 1 The mine ventilation system shall be sized, designed, and constructed for underground operations and in situ site characterization. Additional capacities that will support additional excavations beyond those planned shall be provided as indicated by the uncertainty allowance

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(b) (continued)	1, 2	Sec. 1.2.6.4, PC 5 The location of openings for rock handling shall be selected to minimize effects on the integrity of any other openings
	2	Sec. 1.2.6.4, PC 9 The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule
	2	Sec. 1.2.6.4, PC 10 The size and layout of the shaft shall be adequate for in situ site characterization needs and capable of supporting the excavation allowances determined under... Section 1.2.6.0, Performance Criterion
	2	Sec. 1.2.6.4.2, PC 3 The liner shall include provisions for shaft instrumentation penetrations and data collection units
	2	Sec. 1.2.6.4.5, C 2 The hoist shall be designed to accommodate the uncertainty allowance (see Section 1.2.6.0, Performance Criteria item #2)
	2	Sec. 1.2.6.5, PC 10 The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule
	2	Sec. 1.2.6.5, PC 11 The size and layout of the shaft

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(b) (continued)		shall be adequate for in situ site characterization needs and capable of supporting the excavation allowances determined under... Section 1.2.6.0, Performance Criterion 2.
	1, 2 Sec. 1.2.6.5, C 12	The location of openings for rock handling shall be selected to minimize effects on the integrity of any other openings
	2 Sec. 1.2.6.5.3, PC 2	The station shall have the capacity to accommodate all rock handling requirements from the Main Test level (1020 level)
	2 Sec. 1.2.6.5.5, C 1	The hoist shall accommodate the uncertainty allowance (see Section 1.2.6.0, Performance Criteria item #2).
	2 Sec. 1.2.6.6, PC 16	Instrument cables shall be separated from power cables in drifts to minimize electrical interference. Instrument and IDS cables shall be contained in overhead runs to protect them from damage
	2 Sec. 1.2.6.6, PC 17	The size and layout of the openings excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (see Section 1.2.6.0, Performance Criterion 2)

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(b) (continued)	2	Sec. 1.2.6.6, PC 22 The equipment and facilities required for excavating and handling rock shall meet the needs of construction and testing activities and shall be capable of supporting the uncertainty allowance (see Section 1.2.6.0, Performance Criterion 2.)
	2	Sec. 1.2.6.1.1, PC 1 The openings required for rock handling and for support facilities (e.g., maintenance shops, electric substations, pump stations, refuge chambers, lunch rooms, and storage facilities for supplies and consumables) shall be located away from in situ site characterization testing to minimize interruptions.
	2	Sec. 1.2.6.6.2, PC 2 ESF structures, systems, components, and operations must accommodate additional tests and monitoring if required (see Section 1.2.6.0, Performance Criterion 2).
	2	Sec. 1.2.6.6.2, C 1 Test areas shall be separated so they are not affected by the excavation disturbed zone, geotechnical edge effects, thermal, mechanical, chemical, and hydrological interactions

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(b) (continued)	2	Sec. 1.2.6.7, PC 1 The underground utility systems and service facilities shall have suitable utilities, including power, lights, water and compressed air, as required for construction, operations, and in situ site characterization, and shall be capable of supporting the uncertainty allowances as defined in Section 1.2.6.0, Performance Criterion 2.
	2	Sec. 1.2.6.7.1, PC 1 The underground electrical system shall be sized to meet all operating requirements of the subsurface facility
	2	Sec. 1.2.6.7.1, C 1 The underground power distribution system shall have one primary power feed (steel armored) and a second alternate power feed (steel armored). One power feed shall be installed in each shaft, and adequate switching shall be provided
	2	Sec. 1.2.6.7.9, PC 1 The excavation facilities and equipment required for loading, conveying, and dumping excavated rock shall meet the needs of construction and testing activities and shall be capable of supporting the underground uncertainty allowances (see Section 1.2.6.0, Performance Criterion 2)

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133 (b)	1, 2	Sec. 1.2.6.7.9, PC 3 The location of openings for handling shall be selected to minimize effects on the integrity of any other openings
	2	Sec. 1.2.6.7.9, PC 4 The openings required for handling excavated rock shall be of sufficient size to allow equipment movement in such a way that interference with underground site characterization is minimized
	2	Sec. 1.2.6.7.10, C 1 Redundant systems shall be installed for all systems which monitor potential life threatening conditions
	1, 2	Sec. 1.2.6.8, C 1 Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas
	2	Sec. 1.2.6.8, C 4 Tests shall be classified according to primary information needs (i.e., site characterization, ESF site characterization, ESF design confirmation, repository design, or performance confirmation) and defined with respect to duration, scale, and space requirements. This classification and definition shall be the basis for equipment design, underground layout, ventilation, personnel, and utility requirements

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133 (b) (continued)	2	Sec. 1.2.6.8, A 2 The development of the underground testing program at the ESF has been based upon the qualitative derivation of information needs to satisfactorily address key issues in the Issues Hierarchy. The number of tests may change as site characterization proceeds and more variable or unexpected conditions are encountered. See Section 1.2.6.0, Performance Criterion 2.
	2	Sec. 1.2.6.8, A 3 The underground utility system at the Main test level shall be sufficient to accommodate drifting and testing at any point surrounding the immediate operations area. See Section 1.2.6.7, Underground Utility Systems
	2	Sec. 1.2.6.8.1, C 1 To the extent practicable, utility distribution systems in the testing areas shall be installed to avoid physical interference with test equipment
	2	Sec. 1.2.6.8.1, C 2 Power wiring will be separated from data cabling to the extent practicable, to prevent induced interference
	1, 2	ECR No. 22 In the ESF SDRD, 1.2.6.6 ... make the following changes... (deferring penetration of the Calico Hills unit but maintaining flexibility to do)

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133 (b) (continued)	1, 2 ECR No. 23	In the ESF SDRD, 1.2.6.6.2 ...change to read: "The test areas are defined as those openings excavated in ES-1 (science) shaft at the Upper Demonstration Breakout Room and the Main Test Level for conducting underground site characterization tests at the potential repository horizon and the other geologic horizons."
	1, 2 ECR No. 24	In the ESF SDRD, 1.2.6.8 ...rewrite 1 as follows: "Planned testing and monitoring will be conducted in the ES-1 (science) shaft, the Upper Demonstration Breakout Room and the Main Test Level. The flexibility to drift in the Calico Hills will be maintained
	1, 2 ECR No. 25	In the ESF SDRD, 1.2.6.8.5 ... make the following changes: (1) delete 7 in its entirety. (2) In 11, rewrite the first sentence to "In situ diffusion test measurements shall be made on nonsorbing tracers in the Topopah Spring welded unit"...
60.133(d) The design of the underground facility shall provide for control of water or gas intrusion	1, 2 Sec. 1.2.6.0, A 1	The site shall be located such that, based on expected ground-water conditions, it will be unlikely that engineering measures beyond reasonably available technology will be required for ESF construction, operation, or closure

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(d) (continued)	1, 2	Sec. 1.2.6.1, PC 5 The shafts and shaft collar areas shall be located and/or graded to protect them from the probable maximum flood as defined in the RIB
	1, 2	Sec. 1.2.6.1, A 1 Surface characteristics such as topography, meteorological conditions, and flood potential are important factors in the process of designing surface facilities. It is incumbent upon the designers to include these factors during the design process
	2	Sec. 1.2.6.2.2, PC 7 All water used during operation and construction of the ESF shall be provided with chemical tracers
	2	Sec. 1.2.6.2.2, PC 8 The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing
	2	Sec. 1.2.6.2.2, C 1 The route of the water line shall be adequately marked to minimize the possibility of damage from future construction activities
	2	Sec. 1.2.6.2.5, PC 2 A suitable mine wastewater system shall be provided for collection, pumping, and disposing of expected water and credible water inflows. The system shall be designed to pump all of the collected water to the surface, collect it on the surface, and pump it off site for disposal

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(d) (continued)	2	Sec. 1.2.6.3.1, PC 4 The air quality monitoring system shall have the capability to sample, measure, and analyze physical and chemical conditions consistent with the requirements of applicable federal, state, and local regulations
	2	Sec. 1.2.6.3.1, PC 5 Ventilation provided to and from the underground working areas shall be monitored for radon, methane, oxygen, carbon dioxide, nitrous oxides, carbon monoxide, sulfur dioxide, temperature, humidity, air speed, and volume flow as required by applicable federal, state, and local regulations
	2	Sec. 1.2.6.3.1, A 1 The ventilation monitoring systems for site characterization shall be separate and independent from the monitoring systems required for industrial hygiene and life safety support systems
	1, 2	Sec. 1.2.6.4, PC 3 Structures, systems shall be provided for effective water and ground control.
	1, 2	Sec. 1.2.6.4, PC 6 Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal.
	1, 2	Sec. 1.2.6.4, PC 13 Water handling and control in the shaft shall be sized for credible water inflows

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(d) (continued)	1, 2	Sec. 1.2.6.5, PC 5
		Structures, systems, and components shall be provided for effective water and ground control.
	1, 2	Sec. 1.2.6.5, PC 6
		Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal
	1, 2	Sec. 1.2.6.5, PC 15
		Water handling and control in the shaft shall be sized for credible water inflows
	1, 2	Sec. 1.2.6.5.1, PC 1
		Shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood as defined in the RIB
	2	Sec. 1.2.6.6, PC 13
		Dry air coring will be required for some tests
	1, 2	Sec. 1.2.6.6, PC 18
		Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal
	1, 2	Sec. 1.2.6.6, A 2
		Groundwater inflow will not be an adverse factor during mining operations

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b	
60.133(d) (continued)	1, 2	Sec. 1.2.6.6, A 3	The use of water in the development of underground openings shall be minimized to the extent practicable
	2	Sec. 1.2.6.7.5, C 1	All water used during operation and construction of the ESF shall be provided with chemical tracers as required by testing
	1, 2	Sec. 1.2.6.7.6, PC 1	Gravity drainage, storage, and pumping systems, with adequate capacity and control measures, shall be designed and constructed for the control and transfer to the surface of underground water to ensure worker protection and to preclude adverse effects on in situ site characterization testing
	1, 2	Sec. 1.2.6.7.6, PC 3	The mine wastewater system shall have full operating redundancy, or storage capacity to allow installation of spares
	1, 2	Sec. 1.2.6.7.6, PC 6	The groundwater collection and control system shall be designed to include inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development
	1, 2	Sec. 1.2.6.7.6, PC 7	The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(e) (2) Openings in the underground facility shall be designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock	1	Sec. 1.2.6.4, C 3
	1, 2	Sec. 1.2.6.4, PC 5
	1	1.2.6.4.2, PC 1
	1	Sec. 1.2.6.5, C 3
	1, 2	Sec. 1.2.6.5, C 12
	2	Sec. 1.2.6.6, PC 1
<p>The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. The location of openings for rock handling shall be selected to minimize effects on the integrity of any other openings</p> <p>The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date</p> <p>The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. The location of openings for rock handling shall be selected to minimize effects on the integrity of any other opening</p> <p>Underground openings shall be designed and constructed to minimize impacts on underground site characterization</p>		

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(e) (2) (continued)	1, 2	Sec. 1.2.6.6, PC 3 Underground openings within the Topopah Spring and Calico Hills units shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration
	1, 2	Sec. 1.2.6.6, PC 5 The design of underground openings and their supports shall utilize pillar and openings geometries that limit stress concentration to acceptable levels
	1, 2	Sec. 1.2.6.6, PC 23 Excavation techniques shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass.
60.133(f) The design of the underground facility shall incorporate excavation methods that will limit the potential for creating a preferential pathway for groundwater to contact the waste packages or radionuclide migration to the accessible environment	1, 2	Sec. 1.2.6.4, C 2 Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass
	1	Sec. 1.2.6.4.3, PC 6 Station development shall be performed by controlled blasting techniques
	1, 2	Sec. 1.2.6.5, C 2 Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass
	1	Sec. 1.2.6.5.3, PC 3 Station development shall be performed by controlled blasting techniques

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(f) (continued)	1, 2	Sec. 1.2.6.6, PC 11 Full face, blast hole drilling will be accomplished by using a multi-boom drill jumbo
	1, 2	Sec. 1.2.6.6, PC 23 Excavation techniques shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass
	1, 2	Sec. 1.2.6.6, A 2 Groundwater inflow will not be an adverse factor during mining operations
60.133(h) Engineered barriers. Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure	1	Sec. 1.2.6.0, C 3 The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment
60.133(i) The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response of the host rock, and surrounding strata, groundwater system	1	Sec. 1.2.6.0, C 8 The predicted thermal and thermomechanical response of the host rock and surrounding strata, and the ground-water system shall be considered in the ESF design. Sec. 1.2.6.4, C 8 The predicted thermal and thermomechanical response of the host rock and surrounding strata and groundwater system shall be designed to withstand the anticipated effects.

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.133(i) (continued)		<p>Sec. 1.2.6.4.2, PC 1 The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date.</p> <p>Sec. 1.2.6.5, C 8 The predicted thermal and thermo-mechanical response of the host rock and surrounding strata and groundwater system shall be considered in the ESF design as defined in the RIB. Phased construction techniques shall be employed to accommodate post-construction thermal stresses.</p> <p>Sec. 1.2.6.5.2, PC 1 The shaft liner shall withstand pressure exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date.</p>
60.137 The geologic repository operations area shall be designed so as to permit implementation of a performance confirmation program that meets the requirements of Subpart F of this part	2	Sec. 1.2.6.4, PC 11 Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary.

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Section of 10 CFR Part 60	NRC Concern ^a	SDRD Reference ^b
60.137 (continued)	2	Sec. 1.2.6.4.5, PC 2 The hoisting conveyance shall be designed to permit the inspection of shaft performance monitoring instrumentation, as well as other shaft inspection and maintenance activities
		Sec. 1.2.6.5, PC 12 Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary
	1, 2	Sec. 1.2.6.8, PC 10 Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F
60.140(d)(1) The program shall be implemented so that: It does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives.	1	Sec. 1.2.6.8, PC 10 Sec. 1.2.6.8, C2

^aNRC concerns 1, 2, and 3 taken for TAR Plan.

^bPC = Performance Criterion; C = Constraint; A = Assumption; ECR = Engineering Change Request.

APPENDIX I-3

**ESF-Applicable Criteria Related to
10 CFR Part 60 Requirements for NRC Concerns 1, 2, and 3**

**ESF APPLICABLE CRITERIA
RELATED TO
10 CFR PART 60 REQUIREMENTS
FOR NRC CONCERNS 1, 2, & 3**

JAN 30, 1989

REV. 1

This document contains the list of criteria developed during the TAR to address the three concerns expressed by the NRC regarding the acceptability of ESF Title I Design as it pertains to the Site Characterization Plan and the start of new characterization activities at the Yucca Mountain site, Nevada. The criteria were developed and reviewed by a subcommittee of the Project staff assigned to perform a Design Adequacy Assessment (DAA) of the ESF Title I Design. The scope of that DAA is described in guidance prepared in response to a Technical Assessment Review (TAR) notice. That guidance describes a review of the Title I Design that addresses three concerns expressed by the NRC.

The three NRC Concerns covered by the Criteria List are:

1. The ESF design, construction, and operations should not compromise the ability of the site to isolate waste.
2. The ESF design, construction, and operations should not compromise the ability to characterize the site
3. The ESF design, construction, and operations should provide representative data

The subcommittee assigned responsibility to develop the criteria list followed a multi-step process to develop the criteria list. The criteria developed by the subcommittee specifically address the three concerns expressed by the NRC and are based upon the requirements of 10 CFR Part 60.

The process that the subcommittee followed began with a list of ESF applicable criteria developed by a Task Force at DOE/HQ under the direction of R. Lahoti. The DAA subcommittee examined that list and, following a detailed discussion, developed a correlation matrix of the DOE/HQ list of ESF applicable criteria and each of the three concerns expressed by the NRC. The subcommittee discussed and recorded their impressions of the interfaces to testing, performance assessment, repository design, and site requirements. An "X" was used on the matrix to indicate an interface that is important to the evaluations about the ESF. In several instances interfaces were identified by an "O"; generally, this indicates that an interface is secondary to the interface indicated by the "X". Because the Site Program interfaces are generally defined by the performance assessment program, a decision was made to combine the Performance Assessment and Site Program Interfaces in a single column. In these instances an "S" was used in place of an "X" to indicate Site interfaces. Additionally, the matrix indicates the physical system elements of the ESF for which criteria for compliance with the the specific requirements of the regulation were developed. The effort to develop criteria only below the general "Facility" level was deliberate, to enable less ambiguous evaluation of the ESF design.

The subcommittee documented the notes of these discussions and reached consensus that the matrix developed represented a reasonable starting point for development of the criteria list for evaluation of the Title I design. The subcommittee next developed, for the three NRC concerns, specific criteria for each of the requirements of 10 CFR Part 60 that were considered to be applicable to the ESF Design. Those criteria were developed generally in committee sessions, although some assignments were made to small task forces. The performance criteria developed reflect the judgment of the members of the

subcommittee and encompass information developed during the repository conceptual design and preparation of the performance allocation tables in the SCP. The collected notes of the group were compiled and a working draft of the criteria lists was assembled. This working draft was distributed to the subcommittee for review and discussion of the subject material. The group prepared a mark-up of the draft to record the consensus of the subcommittee and a draft of the Rev. 0 document was prepared.

The subcommittee followed a structured approach to the development of the Criteria List that involved examining, for each applicable Part 60 Requirement, how each of the Physical Elements of the ESF could affect compliance with the Requirement. The interfaces between the Physical Elements, the repository, performance assessment and site, and the testing program were considered in the development of the criteria. It was expected that the development of the Criteria List would involve the identification of specific design features of the ESF that could contribute to the post closure performance of the repository. Likewise it was expected that the development of the Criteria List would involve the identification of activities in the ESF that could affect site processes and properties in ways that could impact the ability of the site to isolate waste. Generally, the features of the ESF that were addressed were those that have been identified as the ESF permanent items, although no attempt was made to limit discussions to these. A primary resource used by the subcommittee in their discussions about the criteria related to the Requirements was the Performance Allocation Tables for the post closure repository design issues of the SCP. The subcommittee also used the existing criteria in the SDRD and the existing evaluations of the ESF Design, including SCP Section 8.4, during these discussions. The notes kept by the committee during these discussions eventually became the first draft of the Criteria List that was used as the basis of the adequacy assessment.

After development of the performance criteria a small group was tasked to do a comparative evaluation of the original matrix of 10 CFR Part 60 requirements correlated to the interfaces and physical elements to ascertain whether the original matrix was accurately reflected in the lists of performance criteria. This evaluation resulted in several changes to the original matrix as some of the expected performance criteria were more properly captured under other elements or different requirements.

The subcommittee was given an opportunity to review the draft Rev. 0 of the criteria lists for each of the three concerns. It was originally planned to meet in committee and discuss the draft prior to finalization. It was not found necessary to do so as the individual reviewers were generally satisfied with the product. The version attached to this memorandum represents differences from the draft given to the committee for review; these differences generally involved the elimination of redundancies, text consolidation, and correction of typographical errors. Because the subcommittee was using the criteria lists to begin their evaluations in parallel to the finalization of the Rev. 0 document, the members of the subcommittee were instructed to ensure that their evaluations were consistent and complete with respect to the Rev. 0 document. Prior to indicating concurrence, the subcommittee received a briefing on the changes between the Rev 0 document and the review draft.

The subcommittee further was instructed that any proposed changes to the Rev.0 document following their signing of this memorandum and the formal issuance of the Rev. 0 document, or any identified deficiencies or dissenting opinions relative to the content of the Rev. 0 document need to be documented.

During discussions about the development of performance criteria, a general philosophy of the manner by which the evaluations about the criteria would be used to address NRC concern 1 was also discussed and a hierarchy developed. A roll-up table was prepared that indicates that in order to show compliance with 60.15(d)(1) and 60.140(d)(1), one must demonstrate that the postclosure performance objectives in 60.112, 60.113(a)(1)(ii)(A), and 60.113(a)(1)(ii)(B) can be met. Demonstration of compliance with the lower level requirements identified in the table will assist in the evaluations of the Performance Objectives. This table was developed originally from the information discussed during preparation of the design criteria sheets developed by the Design Requirements/Criteria subcommittee and was intended to assist in the evaluation of compliance with the 10 CFR 60 requirements applicable to the ESF. The roll-up table signifies specific evaluation criteria to be considered in performing the 10 CFR 60.15(d)(1) and 10 CFR 60 .140(d)(1) required evaluations about ESF construction and site characterization induced impacts on the ability of the site to comply with the Performance Objectives. The roll-up table was originally issued to the group on Dec 22, 1988. The final version is included in the Appendix to this document.

Following completion of the Rev. 0 Criteria List Document, a small committee was tasked to reevaluate the matrix of Part 60 Requirements applicable to ESF Design and the compliance roll-up table for consistency with the Rev. 0 Criteria list Document.

As the committee completed their evaluations against the criteria developed for this DAA it became clear that there were redundancies and omissions in the criteria list. These were documented as they became known and a Rev 1 Document that addressed these concerns was prepared and received the concurrence of the subcommittee. A record of the changes was prepared and is included in the Appendix to this document. As a consistency check, the flowdown matrix and the roll-up matrix were checked against the Rev 1 Document. The revised version of the roll-up table, and the revised version of the flowdown matrix are provided in the Appendix to this document.

On January 18, 1989, DOE/HQ accepted the report entitled "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility - Technical Oversight Group Report," dated December, 1988, and provided it to the project office as a final document for use in the Technical Assessment Review (TAR). When this report was being prepared by the DOE/HQ Technical Oversight Group in December 1988, a draft copy was provided to the TAR team for use as draft input. The chairman of the Technical Oversight Group, Miguel Lugo, who was also a member of the subcommittee, verified that no changes were made to the draft report. Hence the information in the final report is the same as that used by the TAR team to develop the criteria list.

During the development of the Criteria List, copies of the List were given to the group preparing the Title II SDRD to apprise them of the products the subcommittee was developing.

NOTE ON USE OF THE CRITERIA LIST

The Criteria List is arranged in a structured fashion to facilitate reference to a specific entry in the list. The structure allows development of a simple reference code that is used to facilitate reference between the criteria lists and the evaluations about compliance of the ESF with the requirements of 10 CFR Part 60. The structure is based upon a four element reference code, that contains information about the specific NRC concern, 10 CFR Part 60 Requirement, ESF Physical Element, and Criterion.

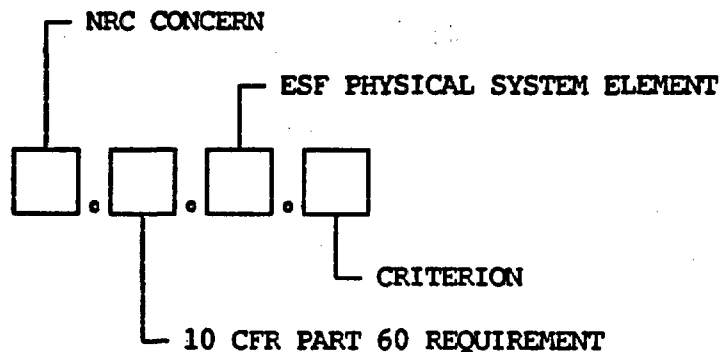
The specific requirements of 10 CFR Part 60 that are addressed by the Criteria list are different for each NRC concern. The requirements that are relevant to each concern are indicated on the attached correlation matrix. Within the reference code, the specific requirements of 10 CFR Part 60 relevant to each of the NRC concerns are assigned a sequential number for each of the NRC concerns.

The third element of the code is based on the nine fourth-level elements of the ESF Physical System Description. These elements are:

- | | |
|-----------------------|---------------------------------|
| 1. ESF SITE | 6. UNDERGROUND EXCAVATIONS |
| 2. UTILITIES | 7. UNDERGROUND UTILITY SYSTEMS |
| 3. SURFACE FACILITIES | 8. UNDERGROUND TESTS |
| 4. FIRST SHAFT | 9. ESF DECOMMISSIONING STRATEGY |
| 5. SECOND SHAFT | |

The fourth element of the reference code is a sequential numbering of the criteria for each specific entry under an ESF Physical System Element.

The reference code is constructed simply from the numbers representing each of the four elements of the reference code separated by decimal points.



NRC CONCERN NO: 1

1.1 Requirement 60.15(d)(1): Investigations to obtain the required information shall be conducted in such a manner as to limit adverse effects on the long term performance of the geologic repository to the extent practicable. *

1.1.1 Site

1.1.1.1 The design of the main pad shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the main pad shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

1.1.2 Surface Utilities

1.1.2.1 The design of the surface utilities, including the waste water ponds and water handling system, shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the surface utilities shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

1.1.4 First shaft

1.1.4.1 The design of the first shaft shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the first shaft shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

1.1.5 Second shaft

1.1.5.1 The design of the second shaft shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the second shaft shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

Requirement 60.15(d)(1) (continued)

1.1.6 Underground excavation

- 1.1.6.1 The design of the underground excavation shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the underground excavation shall be performed in a manner that limits the potential for adverse impacts of the long term performance of the repository

1.1.7 Underground utilities

- 1.1.7.1 The design of the underground utilities shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the underground utilities shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

1.1.8 Underground testing

- 1.1.8.1 The design of the underground testing program shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and implementation and operation of the underground testing program shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository
- 1.1.8.2 Prior to implementing the underground testing program, or prior to implementing additional tests, an evaluation of the potential impacts of such testing on the waste isolation capability of the site shall be performed.

1.1.9 Decommissioning

- 1.1.9.1 The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment

* The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.

1.2 Requirement: 60.15(d)(3) To the extent practical, exploratory boreholes and shafts in the geologic repository operations area shall be located where shafts are planned for underground facility construction and operation or where large unexcavated pillars are planned.

1.2.4 First shaft

1.2.4.1 The shaft pillar is the buffer zone surrounding the shaft beyond which any instability of other underground openings has a negligible effect on shaft stability. Within the shaft pillar area, all facilities and openings shall be designed to be stable for a 100 year life and to limit any adverse effects on the stability of the shafts that could impact the ability of the site to isolate waste

1.2.4.2 The exploratory shafts shall be located, to the extent practicable, where shafts are planned for the repository facility

1.2.5 Second shaft

1.2.5.1 The shaft pillar is the buffer zone surrounding the shaft beyond which any instability of other underground openings has a negligible effect on shaft stability. Within the shaft pillar area, all facilities and openings shall be designed to be stable for a 100 year life and to limit any adverse effects on the stability of the shafts that could impact the ability of the site to isolate waste

1.2.5.2 The exploratory shafts shall be located, to the extent practicable, where shafts are planned for the repository facility

1.2.6 Underground excavation

1.2.6.1 Exploratory boreholes shall be located so that they do not intersect any underground openings

1.2.6.2 For sealing purposes, exploratory boreholes shall be located a minimum distance of 15 m from any underground opening

1.2.6.3 Borehole alignments and location shall be monitored, surveyed, and the results included on all underground working maps

1.2.8 Underground testing

1.2.8.1 MPBH boreholes shall be located in pillars to the extent practicable.

Requirement 60.15(d)(3) (continued)

- 1.2.8.2 Boreholes drilled from the underground portion of the ESF shall not penetrate significantly below the base of the TSW2 host rock, unless the impacts of doing so, on the waste isolation performance of the site, have been evaluated and found to be acceptable

1.3 Requirement: 60.21(c)(1)(ii)(D). The assessment shall contain - The effectiveness of engineered and natural barriers, including barriers that may not be themselves a part of the geologic repository operations area, against the release of radioactive material to the environment. The analysis shall also include a comparative evaluation of alternatives to the major design features that are important to waste isolation, with particular attention to the alternatives that would provide longer radionuclide containment and isolation.

1.3.4 First shaft

- 1.3.4.1 The exploratory shaft locations should be selected, consistent with other goals of site characterization, to limit impacts on isolation.
- 1.3.4.2 The exploratory shaft ground support system should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.
- 1.3.4.3 The exploratory shaft shaft diameter should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the diameter is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.
- 1.3.4.4 The exploratory shaft liner should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the liner is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.
- 1.3.4.5 The exploratory shaft operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed

1.3.5 Second shaft

- 1.3.5.1 The exploratory shaft locations should be selected, consistent with other goals of site characterization, to limit impacts on isolation.
- 1.3.5.2 The exploratory shaft ground support system should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.

Requirement 60.21(c)(1)(ii)(D) (continued)

- 1.3.5.3 The exploratory shaft diameter should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the diameter is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.
- 1.3.5.4 The exploratory shaft liner should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the liner is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed.
- 1.3.5.5 The exploratory shaft operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed

1.3.6 Underground excavation

- 1.3.6.1 The Exploratory Shaft Underground Facility layout, including drift size, should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the layout is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed
- 1.3.6.2 The Exploratory Shaft Underground Facility support system should be designed, consistent with the other goals of site characterization, to limit the impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed
- 1.3.6.3 The Exploratory Shaft Underground Facility operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed

1.4 Requirement: 60.21(c)(11). The Safety Analysis Report shall include: A description of design consideration that are intended to facilitate permanent closure and decontamination or dismantlement of surface facilities.

1.4.1 Site

1.4.1.1 The pad shall be designed to permit the ground to be restored to a contour compatible with its initial conditions.

1.4.4 First shaft

1.4.4.1 The shaft liner shall be designed to be removable prior to permanent closure

1.4.4.2 To prevent complications of seal evaluations and emplacement and limit chemical alteration in future seal environments, no pressure grouting shall take place during the construction period of the shaft at locations of potential seal testing or emplacement. Specifically, no pressure grouting shall be performed within 50 feet of the original ground surface and within 50 feet (above and below) the contact of the Pah Canyon and Topopah Spring tuffs

1.4.4.3 Furnishings in the shafts shall be designed to be removable, if necessary, prior to permanent closure

1.4.5 Second shaft

1.4.5.1 Shaft liners shall be designed to be removable prior to permanent closure

1.4.5.2 To prevent complications of seal evaluations and emplacement and limit chemical alteration in future seal environments, no pressure grouting shall take place during the construction period of the shaft at locations of potential seal testing or emplacement. Specifically, no pressure grouting shall be performed within 50 feet of the original ground surface and within 50 feet (above and below) the contact of the Pah Canyon and Topopah Spring tuffs

1.4.5.3 Furnishings in the shafts shall be designed to be removable, if necessary, prior to permanent closure

1.4.6 Underground excavation

1.4.6.1 The drainage plan for the ESF and long exploratory drifts should be consistent with postclosure sealing concerns

1.4.6.2 Nonpermanent components in the underground openings shall be designed to be removable, if necessary, prior to permanent closure

Requirement: 60.21(c)(11) (continued)

1.4.9 Decommissioning

- 1.4.9.1 The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment

1.5 Requirement: 60.74 (a) DOE shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part. These may include tests of: (1) Radioactive waste, (2) the geologic repository including its structures, systems, and components, (3) radiation detection and monitoring instruments, and (4) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste. (b) The tests required under this section shall include a performance confirmation program carried out in accordance with Subpart F of this part.

1.5.8 Underground testing

- 1.5.8.1 The testing program and underground layout shall be designed with sufficient flexibility that tests that are deemed appropriate by the NRC can be performed. Prior to incorporating such tests, an evaluation of potential impacts on waste isolation shall be performed.
- 1.5.8.2 Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. Prior to incorporating such tests, an evaluation of potential impacts on waste isolation shall be performed.

1.6 Requirement: 60.112 The geologic setting shall be selected and the engineered barrier system and the shafts, boreholes and their seals shall be designed to assure that releases of radioactive materials to the accessible environment following permanent closure conform to such generally applicable environmental standards for radioactivity as may have been established by the Environmental Protection Agency with respect to both anticipated processes and events and unanticipated processes and events. *

1.6.1 Site

1.6.1.1 The Exploratory Shaft Facility pad shall be designed and constructed so that it does not lead to creation of pathways that compromise the repository's capability to meet the performance objective of 10 CFR Part 60.112

1.6.2 Surface Utilities

1.6.2.1 The surface utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112

1.6.4 First shaft

1.6.4.1 The shaft opening shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objectives of 10 CFR Part 60.112

1.6.5 Second shaft

1.6.5.1 The shaft opening shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objectives of 10 CFR Part 60.112

1.6.6 Underground excavation

1.6.6.1 The Exploratory Shaft Facility underground excavation shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objective of 10 CFR Part 60.112

1.6.7 Underground Utilities

1.6.7.1 The underground utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112

Requirement: 60.112 (continued)

1.6.8 Underground testing

1.6.8.1 The testing program shall not affect the capability of the underground repository to meet the performance objective of 10 CFR 60.112

1.6.8.2 Borehole openings shall be designed so that, following permanent closure, they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60.112

1.6.9 Decommissioning

1.6.9.1 The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment

* The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.

1.7 Requirement 60.113(a)(1)(i): The engineered barrier system shall be designed so that, assuming anticipated processes and events: (A) Containment of HLW will be substantially complete during the period when radiation and thermal conditions in the engineered barrier system are dominated by fission product decay; and (B) any release of radionuclides from the engineered barrier system shall be a gradual process which results in small fractional releases to the geologic setting over long times.

1.7.6 Underground excavation

1.7.6.1 The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period.

1.7.7 Underground utilities

1.7.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period.

1.7.8 Underground testing

1.7.8.1 The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction and operation of the underground testing program shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period.

1.8 Requirement 60.113(a)(1)(ii)(A): Containment of HLW within the waste packages will be substantially complete for a period determined by the commission taking into account the factors specified in 60.113 (b) provided that such period shall not be less than 300 years nor more than 1000 years after the permanent closure of the repository. *

1.8.6 Underground excavation

1.8.6.1 The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository.

1.8.7 Underground utilities

1.8.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and construction of the underground utilities shall be performed in a manner intended to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository.

Requirement: 60.113(a)(1)(ii)(A) (continued)

1.8.8 Underground testing

- 1.8.8.1 The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and implementation and operation of the underground testing program shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository.

* The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.

1.9 Requirement 60.113(a)(1)(ii)(B): The release rate of any radionuclide from the engineered barrier system following the containment period shall not exceed one part in 100,000 per year of the inventory of that radionuclide calculated to be present at 1000 years following permanent closure. *

1.9.6 Underground excavation

1.9.6.1 The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure.

1.9.7 Underground utilities

1.9.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure.

Requirement: 60.113(a)(1)(ii)(B) (continued)

1.9.8 Underground testing

- 1.9.8.1 The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure.

* The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.

1.10 Requirement: 60.130: Sections 60.131 through 60.134 specify minimum criteria for the design of the geologic repository operations area. These design criteria are not intended to be exhaustive, however. Omissions in §§ 60.131 through 60.134 do not relieve DOE from any obligation to provide such safety features in a specific facility needed to achieve the performance objectives. All design bases must be consistent with the results of site characterization activities

1.10.1 Site

- 1.10.1.1 Pad operation and construction should limit adverse chemical changes by controlling the use of hydrocarbons, solvents, and chemicals

1.10.4 First shaft

- 1.10.4.1 Shaft operation and construction should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals
- 1.10.4.2 The usage of cement, shotcrete, and grout for bolt anchors or other rock mass support for shaft construction and operations should not exceed requirements for proper construction or safety considerations
- 1.10.4.3 The chemistry of any water used in shaft construction, or operation should be compatible with postclosure requirements to isolate and contain waste
- 1.10.4.4 Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted
- 1.10.4.5 A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning
- 1.10.4.6 The capability to enhance postclosure performance by removing shaft liners shall be retained
- 1.10.4.7 The shaft shall be designed with construction controls that enable flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes

Requirement: 60.130 (continued)

- 1.10.4.8 Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting

1.10.5 Second shaft

- 1.10.5.1 Shaft operation and construction should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals
- 1.10.5.2 The usage of cement, shotcrete, and grout for bolt anchors or other rock mass support shaft construction and operations should not exceed requirements for proper construction or safety considerations
- 1.10.5.3 The chemistry of any water used in shaft construction, or operation should be compatible with postclosure requirements to isolate and contain waste
- 1.10.5.4 Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted
- 1.10.5.5 A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning
- 1.10.5.6 The capability to enhance postclosure performance by removing shaft liners shall be retained
- 1.10.5.7 The shaft shall be designed with construction controls that enable flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes
- 1.10.5.8 Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting

Requirement: 60.130 (continued)

1.10.6 Underground excavation

- 1.10.6.1 The ESF shall be designed with a minimum distance of 75 feet between the centerlines of the adjacent ESF and waste emplacement drifts.
- 1.10.6.2 Underground facility operation and construction should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals
- 1.10.6.3 Underground facility construction and operation should limit cement, shotcrete, and grout for bolt anchors or other rock mass support to that required for proper construction
- 1.10.6.4 The chemistry of any water used in underground excavation construction or operation should be compatible with postclosure requirements to isolate and contain waste
- 1.10.6.5 Fluids and materials planned for use in the underground excavation shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted
- 1.10.6.6 A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning
- 1.10.6.7 The underground excavation shall be designed with construction controls that permit flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes
- 1.10.6.8 Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting

1.10.7 Underground utilities

- 1.10.7.1 Utility systems, including the water distribution and mine wastewater collection systems, shall be designed so that, in the event of seismic activity, the ability of the facility to isolate waste will not be compromised.

Requirement: 60.130 (continued)

1.10.8 Underground testing

- 1.10.8.1 Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted
- 1.10.8.2 The testing program should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals
- 1.10.8.3 The testing program should be executed in a manner that contributes to or does not detract from the isolation capability of the site; for example, by limiting organics in drilling fluids and explosive residues from blasting
- 1.10.8.4 The chemistry of any water used in the testing program should be compatible with isolation and containment objectives.

1.11 Requirement: 60.133(a)(1) The orientation, geometry, layout, and depth of the underground facility, and the design of any engineered barriers that are part of the underground facility shall contribute to the containment and isolation of radionuclides

1.11.4 First shaft

1.11.4.1 The shaft configuration (shaft location, shaft diameter, shaft separation, and shaft depth) should contribute to or not detract from the isolation capability of the site

1.11.5 Second shaft

1.11.5.1 The shaft configuration (shaft location, shaft diameter, shaft separation, and shaft depth) should contribute to or not detract from the isolation capability of the site

1.11.6 Underground excavation

1.11.6.1 The underground facility configuration (drift location, orientation, geometry, and drift sizes) should contribute to or not detract from the capability of the site to isolate and contain waste

1.11.6.2 Overburden above the potential repository horizon must be > 200m

1.11.6.3 If possible, confine Main Test Level facility to TSW2, although TSW1 can be considered

1.11.6.4 Location of underground facility should stay within the conceptual perimeter drift boundary, except as needed to characterize areas outside that boundary, taking into account any potential impacts on the waste isolation capabilities of the site

1.11.6.5 The distance of underground facility openings from exploratory boreholes drilled from the surface should be at least 15m

1.11.6.6 The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening, and considering the closest proximity of any part of each opening).

1.11.6.7 The number of interconnections between the dedicated test area and the repository should be limited to as few as possible, consistent with access and ventilation needs.

Requirement: 60.133(a)(1) (continued)

- 1.11.6.8 The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades.

1.12 Requirement: 60.133(a)(2) The underground facility shall be designed so that the effects of credible disruptive events during the period of operations, such as flooding, fires and explosions, will not spread through the facility

1.12.1 Site

1.12.1.1 The areas around the shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood.

1.12.2 Surface Utilities

1.12.2.1 Water storage tanks should be located, or protection provided to preclude water inflow to ESF following a possible tank failure

1.12.2.2 Piping shall be designed to preclude or limit possible water inflow to the ESF following a pipe rupture.

1.12.4 First shaft

1.12.4.1 The exploratory shaft shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility

1.12.5 Second shaft

1.12.5.1 The exploratory shaft shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility

1.12.6 Underground excavation

1.12.6.1 The Exploratory Shaft Underground Facility shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility

1.12.6.2 The drainage plan for the ESF and long exploratory drifts should be designed to ensure that the effects of flooding shall be limited from spreading through the facility

1.12.6.3 Materials should be selected such that effects of fire do not produce geochemical effects that impact waste isolation capabilities of the site

Requirement 60.133(a)(2) (continued)

- 1.12.6.4 The underground facility should be designed to limit any spread of fire, which could produce geochemical effects that impact waste isolation capabilities of the site
- 1.12.6.5 Operational seals shall be provided where necessary to control the spread of water through the facility

1.12.7 Underground utilities

- 1.12.7.1 Water lines in ESF should be outfitted to limit water inflow to ESF following a possible line rupture
- 1.12.7.2 Effective redundant minewater discharge systems should be provided to limit possible impacts on the isolation capability of the site.
- 1.12.7.3 Fire suppression agents shall be selected such that they do not produce geochemical effects that adversely impact waste isolation capabilities of the site

1.13 Requirement: 60.133(b) The underground facility shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions identified through in situ monitoring, testing, or excavation

1.13.6 Underground excavation

1.13.6.1 The ESF should be designed so as not to interfere with the flexibility of the repository to accommodate specific site conditions

1.13.6.2 The number of interconnections between the dedicated test area and the repository should be limited to as few as practicable.

1.13.6.3 The area of the ESF underground excavations shall be limited to that necessary for conducting the needed site characterization and performance confirmation tests.

1.14 Requirement: 60.133(d) The design of the underground facility shall provide for control of water or gas intrusion.

1.14.1 Site

- 1.14.1.1 The amount of water used in construction, and operations, of the main pad should be limited so as to limit the effects on the containment and isolation capability of the site
- 1.14.1.2 Water use in pad construction shall not adversely impact goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to 90%
- 1.14.1.3 Construction of the main pad shall be performed in a manner to avoid blockage of natural surface water drainageways and avoid creation of surface water impoundments that could impact post-closure performance
- 1.14.1.4 MPBHs or other surface drilled exploratory boreholes associated with the ESF shall be drilled dry
- 1.14.1.5 MPBHs shall incorporate a standpipe or other measures appropriate and adequate for protection against the effects of maximum credible floods during the period when MPBHs are accessible prior to borehole plugging and sealing
- 1.14.1.6 Construction water shall be limited to that required for dust control and proper equipment operation consistent with performance objectives
- 1.14.1.7 Construction procedures shall enable removal of excess water
- 1.14.1.8 Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance

1.14.2 Surface Utilities

- 1.14.2.1 Fluids recovered from sanitary uses or during construction operations should be disposed of in such a way as to avoid potential for performance impacts, for example in lined ponds.

1.14.4 First Shaft

- 1.14.4.1 The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site

Requirement: 60.133(d) (continued)

- 1.14.4.2 Water use in shaft construction should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas
- 1.14.4.3 The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1, and drainage in long drifts should be compatible with repository grades
- 1.14.4.4 The shafts should be separated to maintain reasonable distances for power and instrument cabling and water piping as well as to provide for redundancy in mine water discharge
- 1.14.4.5 Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal
- 1.14.4.6 Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance
- 1.14.4.7 Construction water shall be limited to that required for dust control and proper equipment operation
- 1.14.4.8 Construction procedures shall enable removal of excess water
- 1.14.4.9 Operational seals shall be provided where necessary to control the intrusion of water into the facility
- 1.14.5 Second shaft
 - 1.14.5.1 The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site

Requirement: 60.133(d) (continued)

- 1.14.5.2 Water use in shaft construction should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas
- 1.14.5.3 The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades
- 1.14.5.4 Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal
- 1.14.5.5 Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance
- 1.14.5.6 Construction water shall be limited to that required for dust control and proper equipment operation consistent with performance goals
- 1.14.5.7 Construction procedures shall enable removal of excess water
- 1.14.5.8 Operational seals shall be provided where necessary to control the intrusion of water into the facility
- 1.14.6 Underground excavation
 - 1.14.6.1 The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site
 - 1.14.6.2 Water used in construction and operations should not adversely impact the repository design goals to limit the average saturation of the repository horizon to <75% and limit local saturation to <90% in areas of waste emplacement

Requirement: 60.133(d) (continued)

- 1.14.6.3 The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades
- 1.14.6.4 Construction and operating water shall be limited to that required for dust control and proper equipment operation consistent with performance goals.
- 1.14.6.5 Construction procedure shall enable removal of excess water.
- 1.14.6.6 Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collections point(s) for further treatment and/or disposal
- 1.14.6.7 Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location and water balance
- 1.14.6.8 Operational seals shall be provided where necessary to control the intrusion of water into the facility
- 1.14.7 Underground utilities
 - 1.14.7.1 Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collections point(s) for further treatment and/or disposal
 - 1.14.7.2 The groundwater collection and control system shall be designed to include possible inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development, in addition to expected inflows
 - 1.14.7.3 The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, or a steady flow of 20 GPM

Requirement: 60.133(d) (continued)

1.14.8 Underground testing

- 1.14.8.1 The amount of water used in testing and operations, should be limited so as to limit the effects on the containment and isolation capability of the site
- 1.14.8.2 Water use in testing should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas
- 1.14.8.3 MPBHs or other surface drilled exploratory boreholes associated with the ESF shall be drilled dry
- 1.14.8.4 Testing water should be limited to that required for dust control and proper test operation consistent with performance goals
- 1.14.8.5 Testing procedures shall require removal of excess water
- 1.14.8.6 Any cleaning of ESF walls to facilitate photogrammetry, mapping, or other testing shall be done using compressed air/mist using control procedures
- 1.14.8.7 Test procedures must be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance
- 1.14.8.8 Gaseous products used in characterization should not produce geochemical effects that impact waste isolation capabilities of site

1.15 Requirements: 60.133(e)(2) Openings in the underground facility shall be designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock.

1.15.4 First shaft

1.15.4.1 The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration

1.15.4.2 An adequate distance between shafts should be provided to reduce potential mechanical interference between the two shafts

1.15.5 Second shaft

1.15.5.1 The shaft should be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration

1.15.5.2 An adequate distance between shafts should be provided to reduce potential mechanical interference between the two shafts

1.15.6 Underground excavation

1.15.6.1 The underground excavation be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration

1.15.6.2 The design of underground openings and their supports shall utilize pillar and opening geometries that limit stress concentration to acceptable levels, so as to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration

1.15.6.3 The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening, and considering the closest proximity of any part of each opening).

1.15.6.4 The ESF shall be designed to be consistent with the repository design goal to limit the extraction ratio to less than 30%

1.16 Requirement: 60.133(f) The design of the underground facility shall incorporate excavation methods that will limit the potential for creating a preferential pathway for groundwater to contact the waste packages or radionuclide migration to the accessible environment.

1.16.1 Site

1.16.1.1 Excavation techniques used for pad construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass

1.16.4 First shaft

1.16.4.1 The exploratory shaft construction method should be selected, consistent with other goals of site characterization, to limit impacts on isolation

1.16.4.2 Excavation techniques used for shaft and station construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass

1.16.4.3 Drill and blast specifications should include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability

1.16.4.4 The excavation methods should be compatible with repository design goals to limit permeability changes beyond 3 m from the walls of the excavation to less than one order of magnitude

1.16.5 Second shaft

1.16.5.1 The exploratory shaft construction method should be selected, consistent with other goals of site characterization, to limit impacts on isolation

1.16.5.2 Excavation techniques used for shaft and station construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass

1.16.5.3 Drill and blast specifications should include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability

1.16.5.4 The excavation methods should be compatible with repository design goals to limit permeability changes beyond 3 m from the walls of the excavation to less than one order of magnitude

Requirement: 60.133(f) (continued)

1.16.6 Underground excavation

1.16.6.1 Excavation techniques used for ESF construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass

1.16.6.2 Drill and blast specifications shall include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability

1.17 Requirement: 60.133(h) Engineered barriers. Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure.

1.17.4 First shaft

1.17.4.1 Engineered barriers in the shafts shall assist the geologic setting in limiting the release of radionuclides to the accessible environment

1.17.5 Second shaft

1.17.5.1 Engineered barriers in the shafts shall assist the geologic setting in limiting the release of radionuclides to the accessible environment

1.17.6 Underground excavation

1.17.6.1 The engineered barriers in the underground excavation must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment.

1.17.6.2 The engineered barriers in the underground excavation shall not preclude the repository from creating a waste package environment that favorably controls chemical reactions affecting waste package performance.

1.17.9 Decommissioning

1.17.9.1 The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment

1.18 Requirement: 60.133(i) The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response of the host rock, and surrounding strata, groundwater system.

1.18.4 First shaft

1.18.4.1 The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads

1.18.5 Second shaft

1.18.5.1 The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads

1.18.6 Underground excavation

1.18.6.1 The ESF shall be designed, taking into account the predicted thermal and thermomechanical response of the host rock and surrounding strata so that the performance objectives of the repository can be met

1.18.6.2 The ESF shall be designed such that the thermal and thermomechanical effects of ESF operations and testing do not produce failure of intact rock, nor gross rock mass failure, along potential pathways from the repository to the accessible environment

1.18.6.3 The ESF shall be designed so that the thermal and thermomechanical effects of ESF operations and testing on the groundwater system, do not significantly increase the saturation of the host rock in the waste emplacement area

1.18.6.4 The underground excavation support system shall be designed to withstand pressures under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads

1.18.8 Underground testing

1.18.8.1 The ESF shall be designed such that the thermal and thermomechanical effects of ESF testing does not produce failure of intact rock, nor gross rock mass failure, along potential pathways from the repository to the accessible environment

Requirement: 60.133(i) (continued)

1.18.8.2 The ESF shall be designed so that the thermal and thermomechanical effects of ESF testing on the groundwater system, do not significantly increase the saturation of the host rock in the waste emplacement area

1.18.8.3 The ESF shall be designed so that the thermal effects of ESF testing do not result in temperatures in excess of 115°C in either the TSW3 or CHn units

1.19 Requirement: 60.137 The geologic repository operations area shall be designed so as to permit implementation of a performance confirmation program that meets the requirements of Subpart F of this part.

1.19.6 Underground excavation

1.19.6.1 The underground excavations shall be designed to accommodate the performance confirmation tests required by 60.141 and 60.142, and taking into account any potentially adverse impacts these excavations could have on the waste isolation capabilities of the site

1.19.8 Underground testing

1.19.8.1 The testing program shall accommodate the performance confirmation tests required by 60.141 and 60.142, and taking into account any potentially adverse impacts these tests could have on the waste isolation capabilities of the site

1.20 Requirement 60.140(d): The program shall be implemented so that: (1) it does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives. *

1.20.8 Underground testing

1.20.8.1 The design of the performance confirmation testing program shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and implementation of the performance confirmation testing program and operation of the facility shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository

* The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.

NRC CONCERN NO: 2

2.1 Requirement: 60.74 (a) DOE shall perform, or permit the Commission to perform such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part. These may include tests of: (1) Radioactive waste, (2) the geologic repository including its structures, systems, and components, (3) radiation detection and monitoring instruments, and (4) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste. (b) The tests required under this section shall include a performance confirmation program carried out in accordance with Subpart F of this part.

2.1.4 First shaft

2.1.4.1 The structures, systems, components and operation of the exploratory shafts shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation

2.1.5 Second shaft

2.1.5.1 The structures, systems, components and operation of the exploratory shafts shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation

2.1.6 Underground excavation

2.1.6.1 The dedicated test area should include adequate allowance for additional testing that may be required by the NRC

2.1.6.2 The dedicated test area shall be designed to support such additional testing as may be required by the NRC without disruption of or interference with testing in progress or planned testing

2.1.7 Underground Utilities

2.1.7.1 The structures, systems, components, and operation of the shaft breakouts and main test level of the ESF shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation

2.1.8 Underground testing

2.1.8.1 The underground test program shall be designed to accommodate the requirements of 10 CFR Part 60.74

2.1.8.2 The testing program shall be designed to be able to accommodate additional testing that may be deemed appropriate by the Commission

Requirement: 60.74 (continued)

2.1.8.3 Prior to initiation of additional tests requested by the Commission, an analysis of the potential for the tests to affect the ability of the site to be characterized shall be performed

2.2 Requirement 60.130: Sections 60.131 through 60.134 specify minimum design criteria for the design of the geologic repository operations area. These design criteria are not intended to be exhaustive, however. Omissions in ¶ 60.131 through 134 do not relieve the DOE from any obligation to provide such safety features in a specific facility needed to achieve the performance objectives. All design bases must be consistent with the results of site characterization.

2.2.4 First Shaft

2.2.4.1 Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented

2.2.5 Second Shaft

2.2.5.1 Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented

2.2.6 Underground Excavation

2.2.6.1 Fluids and materials planned for use in the ESF underground facility shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented

2.2.8 Underground Tests

2.2.8.1 Fluids and materials planned for use in testing in the ESF shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented

2.3 Requirement: 60.133(a)(2) The underground facility shall be designed so that the effects of credible disruptive events during the period of operations such as flooding, fires and explosions, will not spread through the facility.

2.3.1 Site

2.3.1.1 The areas around the shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood such that testing in the underground portion of the ESF is not adversely affected

2.3.4 First Shaft

2.3.4.1 The exploratory shaft collar shall be designed to prevent significant water inflow from a maximum credible flooding event during site characterization and the planned period of repository operation, such that testing in the underground portion of the ESF is not adversely affected

2.3.5 Second shaft

2.3.5.1 The exploratory shaft collar shall be designed to prevent significant water inflow from a maximum credible flooding event during site characterization and the planned period of repository operation, such that testing in the underground portion of the ESF is not adversely affected

2.3.6 Underground Excavation

2.3.6.1 The Exploratory Shaft Underground Facility shall be designed so that the effects of credible disruptive events shall be limited from spreading through the facility and affecting characterization

2.3.6.2 The drainage plan for the ESF and long exploratory drifts should be designed to ensure that the effects of flooding shall be limited from spreading through the facility and affecting characterization

2.3.6.3 The presence of combustible materials in the underground facility shall be controlled and limited such that testing in the ESF is not adversely affected

2.3.7 Underground utilities

2.3.7.1 The ESF shall have redundant mine water discharge systems to control and limit the impact of water intrusion on testing in the ESF

2.3.7.2 The underground portion of the ESF shall incorporate a fire protection system to control and limit the impact of a credible fire on testing in the ESF

Requirement: 60.133(a)(2) (continued)

2.3.7.3 The underground utility system shall be designed to control and limit the impact, of utility system failures caused by credible disruptive events such as fire, explosion, or seismic events, on site characterization and other testing

2.3.7.4 The mine water collection, control, and removal system shall be designed with capacity for emergency situations such as unexpected inflow or water line breakage, inflow from penetrations of fault structures during drifting, or from perched water encountered during shaft sinking and ESF development, such that the capability to adequately characterize the site is maintained.

2.4 Requirement: 60.133(b) The underground facility shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions identified through in situ monitoring, testing, or excavation.

2.4.4 First shaft

- 2.4.4.1 The configuration of the shaft shall be adequate to support site characterization testing, and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing
- 2.4.4.2 The design of ES-1 shall include flexibility to deepen the shaft to at least 1,500 feet, or approximately 100' deeper than the Topopah Spring/Calico Hills unit contact, without adversely affecting other testing that may be ongoing. Such flexibility shall consider aspects of hoisting capacity, underground utilities, ground support, and muck handling.

2.4.5 Second shaft

- 2.4.5.1 The configuration of the shaft shall be adequate to support site characterization testing, and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing

2.4.6 Underground excavation

- 2.4.6.1 The ESF shall be designed so that testing areas are separated from possible repository shop, training, operations, or waste emplacement areas, to limit adverse effects from activities in these areas on future testing, including performance confirmation, in the dedicated test area.
- 2.4.6.2 The design of the shaft breakouts and main test level of the ESF shall: (1) limit the extent of interference between tests and (2) limit interference between ESF construction and operation activities and testing activities.

Requirement: 60.133(b) (continued)

- 2.4.6.3 The design of the shaft breakouts and main test level shall have sufficient flexibility to: (1) relocate experiments as necessary to limit interference between tests and aid in ensuring that test location acceptance criteria are met, (2) incorporate additional tests, as needed, in the dedicated test area, (3) allow development and testing in other areas as needed (e.g. southern portion of repository block or Calico Hills Tuff), and (4) accommodate schedule changes as needed
- 2.4.6.4 A contingency plan shall be established for underground excavation to accommodate unexpected or site specific conditions that may be encountered, such as highly fractured zones, lithophysae-rich zones, perched water, or pathways for significant water movement
- 2.4.6.5 The ESF underground excavation shall be of adequate size to support site characterization testing and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the dedicated test area, and capacity to extend an exploratory drift from the main test level, if necessary, up to approximately 10,000 feet to other parts of the repository block.

2.4.7 Underground utilities

- 2.4.7.1 The design of underground utilities for the ESF shall be capable of supporting expansion of the main test level for additional testing and an exploratory drift from the main test level, if necessary, up to approximately 10,000 feet to other parts of the repository block.
- 2.4.7.2 The underground utilities for the ESF shall not preclude monitoring and investigation of in situ conditions, and shall be designed to accommodate site specific conditions, construction, and operation of the ESF.

2.5 Requirement: 60.133(d) The design of the underground facility shall provide for control of water or gas intrusion.

2.5.4 First shaft

- 2.5.4.1 The amount of water used in the construction and operation of the shaft should be limited to preclude interference with tests
- 2.5.4.2 Shaft construction and operating procedures shall require the removal of excess water to preclude interference with tests
- 2.5.4.3 The shafts should be separated to maintain reasonable distances for power and instrument cabling and water piping as well as to provide for redundancy in mine water discharge to preclude interference with tests

2.5.5 Second shaft

- 2.5.5.1 The amount of water used in the construction and operation of the shaft should be limited to preclude interference with tests
- 2.5.5.2 Shaft construction and operating procedures shall require the removal of excess water to preclude interference with tests

2.5.6 Underground excavation

- 2.5.6.1 The amount of water used in construction and operations of the underground facility should be limited to preclude interference with tests
- 2.5.6.2 Underground facility construction and operating procedures shall require the removal of excess water to preclude interference with tests
- 2.5.6.3 The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and not impact the capability to characterize the site. Specifically, drainage in the dedicated test area should be toward ES-1 and that in long drifts should be compatible with repository grades
- 2.5.6.4 Construction methods shall be designed and implemented so that the effects of fluids, gases, or other materials used do not adversely affect the adequacy or reliability of information from site characterization.
- 2.5.6.5 Methods for dust control and cleaning of walls in the underground portion of the ESF shall be designed to limit adverse effects on the adequacy and reliability of information from site characterization

Requirement: 60.133(d) (continued)

2.5.6.6 Fluids, gases, and other materials used in ESF construction and operations, and/or injected into the rock mass, shall be appropriately tagged. Selection of tracers shall consider, but not be limited to: (1) the possible future need to account for the mobility and disposition of all such materials as part of site characterization, and (2) the effects of tracers on site characterization

2.5.7 Underground utilities

2.5.7.1 The mine water collection, control, and removal system shall be designed to accommodate inflow from penetrations of fault structures during drifting, or from perched water encountered during shaft sinking and ESF development such that the capability to adequately characterize the site is maintained. The mine water control system shall be designed with capacity for emergency situations such as unexpected inflow or water line breakage.

2.5.7.2 The design of the ESF underground utility system, including ventilation, shall facilitate monitoring of moisture influx to the ESF from the rock mass and from ventilation, and moisture efflux from mine water removal and ventilation exhaust to limit possible impacts on the capability to adequately characterize the site.

2.5.8 Underground Testing

2.5.8.1 The amount of water used in testing in the shaft should be limited to preclude interference with tests

2.5.8.2 Test procedures shall require the removal of excess water

2.5.8.3 Test procedures shall be developed to ensure that water entering the ESF is managed appropriately, including quantity, location, and water balance

2.6 Requirement: 60.133(e)(2) Openings in the underground facility shall be designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock.

2.6.4 First Shaft

- 2.6.4.1 The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that could impact the capability to reliably and adequately characterize the site
- 2.6.4.2 An adequate distance between shafts shall be provided to limit potential mechanical and hydrological interference between the two shafts to the extent that it could impact the capability to reliably and adequately characterize the site

2.6.5 Second Shaft

- 2.6.5.1 The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that could impact the capability to reliably and adequately characterize the site
- 2.6.5.2 An adequate distance between shafts shall be provided to limit potential mechanical and hydrological interference between the two shafts to the extent that it could impact the capability to reliably and adequately characterize the site

2.6.6 Underground excavation

- 2.6.6.1 The main test level of the ESF shall be designed to limit overall response to excavation, including rock fall, considering all planned drifts and future drifting that may be performed in the dedicated test area, consistent with obtaining adequate and reliable information from site characterization
- 2.6.6.2 The design of underground openings and their supports in the ESF shall utilize pillar and opening geometries that limit stress concentration, changes in rock mass permeability, and changes in rock mass deformability to levels consistent with acquiring adequate and reliable information from site characterization
- 2.6.6.3 The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening and considering the closest proximity of any part of each opening) consistent with obtaining reliable and adequate information from site characterization

Requirement: 60.133(e)(2) (continued)

2.6.8 Underground testing

- 2.6.8.1 The ESF shall be designed to limit mechanical, hydrologic, or geochemical interference between underground tests that may be associated with damage to the rock mass caused by excavation

2.7 Requirement: 60.133(f) The design of the underground facility shall incorporate excavation methods that will limit the potential for creating a preferential pathway for groundwater to contact the waste packages or radionuclide migration to the accessible environment.

2.7.1 Site

2.7.1.1 The main pad shall be constructed using excavation methods that will limit damage to the underlying rock mass to the extent that it could affect the adequacy or reliability of information from site characterization. Methods shall be designed to facilitate investigation and monitoring of such effects during and after construction

2.7.4 First Shaft

2.7.4.1 The shaft and shaft stations of the exploratory shaft shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of information from site characterization. The methods shall be designed to facilitate investigation and monitoring of such effects during and after construction

2.7.5 Second shaft

2.7.5.1 The shaft and shaft stations of the exploratory shaft shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of information from site characterization. The methods shall be designed to facilitate investigation and monitoring of such effects during and after construction

2.7.6 Underground excavation

2.7.6.1 The shaft breakouts and main test level of the ESF shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of site characterization. The methods shall be designed to provide for the requirements of specific site characterization tests, such as limitations on the extent of excavation-induced damage, or the type of ground support that may be installed. The methods shall be designed to facilitate monitoring and investigation of excavation effects during and after construction

2.8 Requirement: 60.137 The geologic repository operations area shall be designed so as to permit implementation of a performance confirmation program that meets the requirements of Subpart F of this part.

2.8.1 Site

2.8.1.1 The ESF site shall be designed to facilitate appropriate performance confirmation measurement and monitoring to obtain adequate and reliable information about the site. The performance confirmation program shall include measurement and monitoring of the performance of the ESF site to the extent that aspects of the site are part of the geologic setting that could contribute to the waste isolation performance of a repository.

2.8.4 First shaft

2.8.4.1 The configuration of the shaft shall be adequate to support performance confirmation testing, and future performance confirmation testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing

2.8.4.2 The shafts of the ESF shall be designed to facilitate performance confirmation testing to obtain adequate and reliable information about the site, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F

2.8.4.3 The shafts of the ESF shall be designed so that baseline performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository.

2.8.5 Second shaft

2.8.5.1 The configuration of the shaft shall be adequate to support site performance confirmation testing, and future performance confirmation testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing

Requirement: 60.137 (continued)

- 2.8.5.2 The shafts of the ESF shall be designed to facilitate performance confirmation testing to obtain adequate and reliable information about the site, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F
- 2.8.5.3 The shafts of the ESF shall be designed so that baseline performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository.

2.8.6 Underground excavation

- 2.8.6.1 The shaft breakouts and main test level of the ESF shall be designed to facilitate performance confirmation testing, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F
- 2.8.6.2 The shaft breakouts and main test level of the ESF shall be designed so that baseline performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository.
- 2.8.6.3 The ESF underground excavation shall be of adequate size to support performance confirmation testing and future testing that may be reasonably expected for performance confirmation. This shall include an allowance to accommodate site specific conditions encountered in the dedicated test area.
- 2.8.6.4 The design of the shaft breakouts and main test level of the ESF shall: limit the extent of interference between characterization tests, performance confirmation tests and ESF construction and operation activities
- 2.8.6.5 The design of the shaft breakouts and main test level shall have sufficient flexibility to: (1) relocate experiments as necessary to limit interference between tests, (2) incorporate additional performance confirmation tests, as needed, in the dedicated test area, and, (3) accommodate schedule changes as required

Requirement: 60.137 (Continued)

2.8.7 Underground Utilities

2.8.7.1 The design of underground utilities for the ESF shall be capable of supporting the performance confirmation testing

2.8.7.2 The underground utilities for the ESF shall not preclude monitoring and investigation of in situ conditions, and shall be designed to accommodate site specific conditions, construction, and operation of the ESF

2.8.8 Underground testing

2.8.8.1 Performance confirmation testing shall be conducted in the ESF during and after construction, to meet the requirements which pertain to such testing in the geologic repository as stated in 10 CFR 60, Subpart F

NRC CONCERN NO: 3

3.1 Requirement: 60.15(b) Unless the Commission determines with respect to the site described in the application that it is not necessary, site characterization shall include a program of in situ exploration and testing at the depths that wastes would be emplaced.

3.1.4 First shaft

3.1.4.1 Shaft design and construction shall provide access for site characterization activities to be performed at the planned waste emplacement horizon

3.1.4.2 Selection of the horizon for the main test level shall be based on evaluation of stratigraphic information sources available during construction (e.g., from the MPBH activity, geologic mapping of the shafts, and a probe corehole drilled ahead of the shaft face in portions of the shaft) with respect to explicit horizon criteria

3.1.5 Second shaft

3.1.5.1 Shaft design and construction shall provide access for site characterization activities to be performed at the planned waste emplacement horizon

3.1.5.2 Selection of the horizon for the main test level shall be based on evaluation of stratigraphic information sources available during construction (e.g., from the MPBH activity, geologic mapping of the shafts, and a probe corehole drilled ahead of the shaft face in portions of the shaft) with respect to explicit horizon criteria

3.1.6 Underground excavation

3.1.6.1 The ESF main test level shall be constructed at the planned repository horizon

3.1.8 Underground testing

3.1.8.1 Underground testing shall be conducted in a facility constructed at the planned repository horizon

3.2 Requirement: 60.15(d)(2) The number of exploratory boreholes and shafts shall be limited to the extent practical consistent with obtaining the information needed for site characterization.

3.2.4 First Shaft

3.2.4.1 The number and depth of exploratory shafts shall be consistent with obtaining needed information for site characterization, while contributing to acquisition of representative data

3.2.5 Second Shaft

3.2.5.1 The number and depth of exploratory shafts shall be consistent with obtaining needed information for site characterization, while contributing to acquisition of representative data

3.2.8 Underground testing

3.2.8.1 The number and length of exploratory and monitoring boreholes drilled from the underground portion of the ESF shall be consistent with obtaining the needed information for site characterization

3.3 Requirement: 60.15(d)(3) To the extent practical, exploratory boreholes and shafts in the geologic repository operations area shall be located where shafts are planned for underground facility construction and operation or where large unexcavated pillars are planned.

3.3.8 Underground testing

3.3.8.1 Exploratory, monitoring and testing boreholes shall be located where pillars are planned in the repository underground facility to the extent practicable. Implementation of this criterion within the designated test area of the ESF shall be consistent with obtaining the needed information for site characterization

3.4 Requirement 60.74 (a) DOE shall perform, or permit the Commission to perform such tests as the commission deems appropriate or necessary for the administration of the regulations in this part. These may include tests of: (1) Radioactive waste, (2) the geologic repository including its structures, systems, and components, (3) radiation detection and monitoring instruments, and (4) other equipment and devices used in connection with the receipt, handling, or storage of radioactive waste. (b) The tests required under this section shall include a performance confirmation program carried out in accordance with Subpart F of this part.

3.4.8 Underground testing

3.4.8.1 The area set aside for future site characterization and performance confirmation testing, shall be representative of the overall designated test area with respect to rock characteristics that control acceptability of test locations

3.5 Requirement: 60.133(b) The underground facility shall be designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site conditions identified through in situ monitoring, testing, or excavation.

3.5.4 First shaft

3.5.4.1 The shaft design shall have the flexibility needed to ensure that the location, orientation, geometry, and configuration of each test can be modified, as necessary to meet specific test location acceptance criteria for each test in the shaft, in response to actual site conditions encountered during construction

3.5.5 Second shaft

3.5.5.1 The shaft design shall have the flexibility needed to ensure that the location, orientation, geometry, and configuration of each test can be modified, as necessary to meet specific test location acceptance criteria for each test in the shaft, in response to actual site conditions encountered during construction

3.5.6 Underground excavation

3.5.6.1 The design of the shaft breakouts, and the layout of the main test level of the ESF, shall have the flexibility to ensure that the location, orientation, geometry, and configuration of each planned test can be modified, as necessary, to meet specific test location acceptance criteria, in response to actual site conditions encountered during construction

3.5.7 Underground utilities

3.5.7.1 The design of the underground utilities shall provide the flexibility needed to support required flexibility in the design of the shafts, shaft breakouts, and the layout of the main test level of the ESF

APPENDIX

**CORRELATION OF CRITERIA DERIVED FOR ESF PHYSICAL ELEMENTS
WITH 10 CFR PART 60 APPLICABLE REQUIREMENTS**

**CRITERIA ROLL-UP FOR CONSIDERATION IN EVALUATIONS
OF PERFORMANCE OBJECTIVES**

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

**CORRELATION OF CRITERIA DERIVED FOR ESF PHYSICAL ELEMENTS
WITH 10 CFR PART 60 APPLICABLE REQUIREMENTS**

	C O N C E R N	I N T E R F A C E				E S F P H Y S I C A L E L E M E N T S									
		T E S T I N G	P A & S I T E	R E P O S	O T H E R	F A C I L	S I T E	U T I L S	S U R F F A C	1 S T S H E T	2 N D S H E T	U G E X C	U G U T I L	U G T E S T	D E C O M
1 60.15(b) ..in situ explor at depth of wste emplacmnt Δ2	3	X	S	X						√	√	√		√	
2 60.15(d) (1) .. limit impacts on isol Δ2	1	O	X	O			√	√		√	√	√	√	√	√
(2) ...limit no. boreholes Δ2	3	X	S							√	√			√	
(3) ...boreholes/shafts in pillars Δ1	1	X		X						√	√	√		√	
Δ2	3		O	X										√	
(4) ...coord drilling with GROA Δ2															
3 60.16 ...issue SCP & receive comments on shaft															
4 60.21(c) (1) (ii) (D) ...comparative evaluation (a) Δ1	1		X							√	√	√			
5 60.21(c) (1) (ii) (E) ...items imp. to safety															
6 60.21(c) (11) ...features to facilitate closure (b) Δ1 Δ2	1			X			√			√	√	√			√
7 60.72(a) ...maintain records															
8 60.72(b) ...types of records															
9 60.74 ...NRC defined tests Δ2	1	X												√	
(c)	2	X								√	√	√	√	√	
	3	X	S											√	
10 60.111(a) ..Part 20 compliance															
11 60.111(b) (1) ..preserve the option of waste retrieval															
12 60.111(b) (3) ...retrieval schedule															
13 60.112 ...Total System Performance (d) Δ2 Δ3	1	O	X	O			√	√		√	√	√	√	√	√
14 60.113(a) (1) (i) ...sub. comp. cont & release rate Δ2 Δ3	1	O	X	O								√	√	√	

			C O N C E R N	I N T E R F A C E				E S F P H Y S I C A L E L E M E N T S									
				T E S T I N G	P A S S I T E	R E P O S	O T H E R	F A C I L	S I T E	U T I L S	S U R F F A C	I N S T R U C T I O N	2 N D S H F T	U G E X C	U G U T I L	U G T E S T	D E C O M
15	60.113(a) (1) (ii) (A) ...300 to 1000 yr W. Pkg.	$\Delta 2 \Delta 3$	1	O	X	O								✓	✓	✓	
	(a) (1) (ii) (B) ... 10^{-5} release rate	$\Delta 2 \Delta 3$	1	O	X	O								✓	✓	✓	
16	60.130 ...other features to meet P.O. (m)	$\Delta 1$	1			X			✓			✓	✓	✓	✓	✓	
		$\Delta 2$	2	X	O							✓	✓	✓		✓	
17	60.131(b) (1) ..SS/C imp. safety consider nat features																
18	60.131(b) (2) ..SS/C imp. safety prot dynamic																
19	60.131(b) (3) ...SS/C imp. safety prot fire/explosion																
20	60.131(b) (4) (i)...SS/C imp. safety maintain control																
21	60.131(b) (6) ...SS/C imp. safety inspect, test																
22	60.131(b) (9) ...compliance mining regulations (e)																
23	60.133(a) (1) ...orientation contrib. to isol (f) (g) (h) $\Delta 1$		1			X						✓	✓	✓			
	(2) ...disruptive events not spread (i) (j) $\Delta 1$		1			X			✓	✓		✓	✓	✓	✓		
		$\Delta 2$	2	X					✓			✓	✓	✓	✓		
24	60.133(b)ug facil flexible for site conditions		1	X		X								✓			
		$\Delta 2$	2	X		X						✓	✓	✓	✓		
	(g) $\Delta 2$		3	X	S	X						✓	✓	✓	✓		
25	60.133(c) ...retrieval of waste																
26	60.133(d) ...control water and gas (i) $\Delta 1 \Delta 2$		1			X			✓	✓		✓	✓	✓	✓	✓	
		$\Delta 2$	2	X		X						✓	✓	✓	✓	✓	

	C O N C E R N	I N T E R F A C E				E S F P H Y S I C A L E L E M E N T S									
		T E S T I N G	P A & S I T E	R E P O S	O T H E R	F A C I L	S I T E	U T I L S	S U R F F A C	1 S T S H F T	2 N D S H F T	U G E X C	U G U T I L	U G T E S T	D E C O M
27 60.133(e) (1) ...retrievability															
60.133(e) (2) deleterious movement (h) Δ1	1			X						√	√	√			
Δ2	2	X								√	√	√		√	
28 60.133(f) ...excavation effects (k) (h)	1			X			√			√	√	√			
(1) Δ2	2	X					√			√	√	√			
29 60.133(g) ...ventilation															
30 60.133(h) ...ebs assist geol setting (h) Δ1 Δ2	1		O	X						√	√	√			√
31 60.133(i) ...thermal/mechanical loads (h) Δ1	1			X						√	√	√		√	
32 60.137...performance confirmation Δ1	1	X		X								√		√	
Δ2	2		O	X			√			√	√	√	√	√	
33 60.140(b) ...start perf. con. during site char.															
34 60.140(c) ...appropriate monitoring pgm															
35 60.140(d) (1)...pgm not affect nat & eng bar meet P.O . (n) Δ2	1	O	X	O										√	
36 60.141(a) ... surveil, mapping, testing															
37 60.141(b) ...monitor design															
38 60.141(c) ...req'd measurements															
39 60.141(d) ...comp. to orig design															
40 60.141(e) ...monitor therm/mech															
41 60.142(a) ...borehole/shaft seals															

	C O N C E R N	I N T E R F A C E				E S F P H Y S I C A L E L E M E N T S									
		T E S T I N G	P A & S I T E	R E P O S	O T H E R	F A C I L	S I T E	U T I L S	S U R F F A C	1 S T S H F T	2 N D S H F T	U G E X C	U G U T I L	U G T E S T	D E C O M
42 60.142(b) ...initiated early															
43 60.142(c) ...test backfill effect.															
44 60.142(d) ...seal effect.															
45 60.151 QA Program Applicability															
46 60.152 QA Pgm Basis															

Footnotes

- a) possible questions about shaft location; possible interface to other
- b) SDRD shows this element addressing repository decommissioning also
- c) "S" here is for addressing representativeness
- d) element addressing water utilities needs to be defined
- e) safety related concerns about shaft separation go here (?)
- f) interface could include shaft diameter, location (contrib/not affect)
- g) address drifting to target structures
- h) 60.133 paras do not apply to shafts but a comprehensive treatment of 60.15(d)(1) requires blast control, water control, etc
- i) construction water control in 133(d), tank, pump, line failures in 133(a)(2)
- j) element addressing water handling utilities needs to be defined
- k) need to consider location, diameter, etc becoming a pathway (ie higher potential for creating a pathway)
- l) items such as controlled blasting
- m) materials (chemistry) control; water control in 133(d) and 133(a)(2)
- n) must be as 60.15(d)(1); includes both site and PA interface
- Δ1 revision 1, 12/22/88
- Δ2 revision 2, 1/07/89
- Δ3 revision 3, 1/30/89 final consistency check

**CRITERIA ROLL-UP FOR CONSIDERATION IN EVALUATIONS
OF PERFORMANCE OBJECTIVES**

	60.15d1 EVALUATION			60.15d1 EVALUATION			60.140d1 EVALUATION		
	ESF CONST / OPS IMPACTS			TESTING IMPACTS			TESTING IMPACTS		
	TOTAL SYSTEMS 60.112	W.PKG LIFE .113aliiA	RELEASE RATE .113aliiB	TOTAL SYSTEMS 60.112	W.PKG LIFE .113aliiA	RELEASE RATE .113aliiB	TOTAL SYSTEMS 60.112	W.PKG LIFE .113aliiA	RELEASE RATE .113aliiB
SITE	.130 .133a2 .133d .133f								
SURF UTILS	.133a2 .133d								
1ST & 2ND SHAFT	.15d3 .21cliid .130 .133a1 .133a2 .133d .133e2 .133f .133h .133i								
U.G. EXCAV	.15d3 .21cliid .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i	.15d3 .21cliid .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i	.15d3 .21cliid .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i				.137	.137	.137
UG UTILS	.130 .133a2 .133d	.130 .133a2 .133d	.130 .133a2 .133d						
UG TESTS				.15d3 .74 .130 .133d .133i	.15d3 .74 .130 .133d .133i	.15d3 .74 .130 .133d .133i	.74 .130 .133d .133i .137	.74 .130 .133d .133i .137	.74 .130 .133d .133i .137
DECOMM	.133h	.133h	.133h						

CRITERIA ROLL-UP FOR COMPLIANCE WITH PERFORMANCE OBJECTIVES JAN 30, 1989

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

JAN 29, 1989

PAGE 1 of 3

The following changes to the Rev. 0 Criteria List Document have been incorporated in the Rev.1 Document.

1. 1.14.7.3 eliminated, as being redundant with other fluid criteria.
2. Due to numbering error in Revision 0, criterion 1.14.8.8, 1.14.8.9, and 1.14.8.10 are renumbered 1.14.8.7, 1.14.8.8, and 1.14.8.9, respectively
3. Due to numbering error, Criterion 1.18.5.2 is renumbered 1.18.5.1
4. Move Criterion 1.14.6.10 to 1.14.7.3 since the design of the storage and pumping system is part of the underground utility system
5. Criterion 1.14.4.7, 1.14.5.6 and 1.14.6.9 have been eliminated as being redundant because responsibility for groundwater collection and control is in Criterion 1.14.7.2. Renumber subsequent criteria in each of the three locations.
6. Criterion 1.16.6.3 eliminated because it was redundant with 1.15.6.3
7. Full numbers added to abbreviated numbering system used in Revision 0
8. Criterion 1.4.6.1 "drift" changed to "drifts".
9. Criterion 2.5.6.3 delete "shaft" in first line.
10. Criterion 1.11.6.2 clarified so that 200 m overburden refers to potential repository horizon.
11. Criterion 1.2.8.2 deleted as it was a constraint on the MPBH and not the ESF; subsequent criterion renumbered.
12. Additional text added to citation for Requirements 1.3 and 1.4 to reflect more accurately the wording in 10 CFR Part 60
13. Criterion under 3.3.8, "o" changed to "1", becoming 3.3.8.1
14. Criterion 3.5.7.1, delete "in" on second line.

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

JAN 29, 1989

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15. Footnote: "The approach adopted for evaluation of the adequacy of this 10 CFR Part 60 Requirement involves consideration of criteria developed under other 10 CFR Part 60 Requirements. Rather than listing each of those criteria here, a matrix indicating those criteria that were considered in the evaluation of this 10 CFR Part 60 Requirement is presented in the Figure Appended to this Document.", added to Requirements 1.1, 1.6, 1.8, 1.9, and 1.20 to clarify consideration of other criteria in evaluation of adequacy of treatment of Requirement in the ESF design.
16. Typographical errors or extraneous text removed in Criteria 1.17.6.1, 2.8.5.1, and 1.18.8.3.
17. Criterion 1.14.2.1 changed to "during construction".
18. Delete Criteria 1.14.4.3, 1.14.5.3, 1.14.6.3, and 1.14.8.4 as being redundant with and more properly treated under 1.14.2.1. The intent of the Criteria is addressed under Criteria 1.14.4.6, 1.14.5.5, 1.14.6.7, and 1.14.8.6. Renumber subsequent criteria in each of the four locations.
19. Add the following criterion which was inadvertently omitted from the criteria list but which was addressed in the DAA:

1.8.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and construction of the underground utilities shall be performed in a manner intended to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository.
20. Add the following criterion which was inadvertently omitted from the criteria list but which was addressed in the DAA:

1.9.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure.

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

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21. Add the following criterion which was inadvertently omitted from the criteria list but which was addressed in the DAA:

1.7.7.1 The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period.

22. Under 1.4.1 Site, the criterion is now correctly numbered 1.4.1.1.

23. In criterion 1.7.8.1, "excavation" changed to "testing program".

24. Under 2.1.7 Underground utilities, the criterion is now correctly numbered 2.1.7.1.

25. Under 2.1.8 Underground testing, the three criteria are now correctly numbered 2.1.8.1, 2.1.8.2, and 2.1.8.3.

26. The interim changes issued on Jan 10, 1989 have been incorporated in the Rev. 1 document. (copy attached)

☒ Accepted

☐ Accepted, excluding _____, _____, _____

M. Lugo Miguel Lugo 1/30/89

E. Hardin Ed Hardin 1/30/89

A. Girdley W. A. Girdley 1/30/89

D. Ross-Brown M. K. Brown 1/30/89

J. Tillerson Joe Tillerson 1/30/89

M. Voegle Michael Voegle 1/30/89

B. Crowe Bruce Crowe 1/30/89

SUMMARY OF CHANGES TO REV. 0 CRITERIA LIST DOCUMENT

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1. Revise 1.10.4.2 and 1.10.5.2 as follows:
 2. The usage of cement, shotcrete, and grout for bolt anchors or other rock mass support for shaft construction and operations should not exceed requirements for proper construction or safety considerations.
2. Revise 2.5.4.3 as follows:
 3. The shafts should be separated to maintain reasonable distances for power and instrument cabling and water piping as well as to provide for redundancy in mine water discharge to preclude interference with tests.
3. Revise 2.7.1.1 as follows:
 1. The main pad shall be constructed using excavation methods that will limit damage to the underlying rock mass to the extent that it could affect the adequacy or reliability of information from site characterization. Methods shall be designed to facilitate investigation and monitoring of such effects during and after construction.
4. Add Requirement 1.6.2.1 as follows:
 1. The surface utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112
5. Add Requirement 1.6.7.1 as follows:
 1. The underground utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112

(☒) Accepted.

(☐) Accepted, excluding _____, _____, _____.

M. Lugo Miguel Lugo 1/10/89

E. Hardin

Ernest L. Hardin

1-10-89

A. Girdley

W. A. Girdley 1-10-89

D. Ross-Brown

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B. Crowe 1-10-89

APPENDIX I-4

ESF Criteria Addressed in Title 1 SDRD

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
(page 1 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1				
60.15 (d) (1)	Site	The design of the main pad shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the main pad shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Utilities	The design of the surface utilities, including the waste water ponds and water handling system, shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the surface utilities shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	First shaft	The design of the first shaft shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the first shaft shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Second shaft	The design of the second shaft shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the second shaft shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground excavation	The design of the underground excavation shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the underground excavation shall be performed in a manner that limits the potential for adverse impacts of the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.15(d) (1) (continued)	Underground utilities	The design of the underground utilities shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and construction and operation of the underground utilities shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground testing	The design of the underground testing program shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and implementation and operation of the underground testing program shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Partially	Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2) (This criterion is partially addressed by the lower-level criteria covered later in this table)
		Prior to implementing the underground testing program, or prior to implementing additional tests, an evaluation of the potential impacts of such testing on the waste isolation capability of the site shall be performed.	N	
	Decommissioning	The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment	Y	The ESF shall be designed, constructed, and operated to meet decommissioning and closure requirements of applicable federal, state, and local codes. (SDRD 1.2.6.9, Performance Criterion 1)
60.15(d) (3)	First shaft	The shaft pillar is the buffer zone surrounding the shaft beyond which any instability of other underground openings has a negligible effect on shaft stability. Within the shaft pillar area, all facilities and openings shall be designed to be stable for a 100 year life and to limit any adverse effects on the stability of the shafts that could impact the ability of the site to isolate waste	Y	Permanent shaft structures, systems, and components shall be designed and constructed for maintainable 100-year design life. (SDRD 1.2.6.4, Performance Criterion 2)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
(page 3 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.15(d) (3) (continued)	First shaft (continued)	The exploratory shafts shall be located, to the extent practicable, where shafts are planned for the repository facility.	Y	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. (SDRD 1.2.6.4, Constraint 9)
	Second shaft	The shaft pillar is the buffer zone surrounding the shaft beyond which any instability of other underground openings has a negligible effect on shaft stability. Within the shaft pillar area, all facilities and openings shall be designed to be stable for a 100 year life and to limit any adverse effects on the stability of the shafts that could impact the ability of the site to isolate waste.	Y	Permanent shaft structures, systems, and components shall be designed and constructed for a maintainable 100-year design life. (SDRD 1.2.6.5, Performance Criterion 2)
		The exploratory shafts shall be located, to the extent practicable, where shafts are planned for the repository facility.	Y	The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System shall be N766,337; E563,918. (SDRD 1.2.6.5, Constraint 10)
	Underground Excavation	Exploratory boreholes shall be located so that they do not intersect any underground openings.	N	
		For sealing purposes, exploratory boreholes shall be located a minimum distance of 15 m from any underground opening.	N	
		Borehole alignments and location shall be monitored, surveyed, and the results included on all underground working maps.	N	
	Underground Testing	MPBH boreholes shall be located in pillars to the extent practicable.	N	
		Boreholes drilled from the underground portion of the ESF shall not penetrate significantly below the base of the TSW2 host rock, unless the impacts of doing so, on the waste isolation performance of the site, have been evaluated and found to be acceptable.	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c)(1)(ii)(D)	First shaft	The exploratory shaft locations should be selected, consistent with other goals of site characterization, to limit impacts on isolation	N	
		The exploratory shaft ground support system should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.4, Constraint 5).
		The exploratory shaft diameter should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the diameter is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	The size and shape of the shaft shall be adequate to supply and exhaust the required volumes of air for underground construction, operation, and in situ site characterization. (SDRD 1.2.6.4, Performance Criterion 8) The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule. (SDRD 1.2.6.4, Performance Criterion 9) The shaft shall be designed and constructed such that its nominal finished inside diameter is 12 feet. (SDRD 1.2.6.4, Constraint 12)
		The exploratory shaft liner should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the liner is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	N	
		The exploratory shaft operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c) (1) (ii) (D) (continued)	First shaft (continued)	The exploratory shaft locations should be selected, consistent with other goals of site characterization, to limit impacts on isolation	N	
	Second shaft	The exploratory shaft ground support system should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.5, Constraint 5).
		The exploratory shaft diameter should be selected, consistent with other goals of site characterization, to limit impacts on isolation. If the diameter is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	The size and shape of the shaft shall be adequate to supply and exhaust the required volumes of air for underground construction, operation, and in situ site characterization. (SDRD 1.2.6.5, Performance Criterion 8)
				The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule. (SDRD 1.2.6.5, Performance Criterion 10)
				The shaft shall be designed and constructed such that its nominal finished diameter is 12 feet. (Constraint 9)
		The exploratory shaft liner should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the liner is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	N	
60.21(c) (1) (ii) (D)	Second shaft	The exploratory shaft operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c) (1) (ii) (D) (continued)	Underground excavation	The Exploratory Shaft Underground Facility layout, including drift size, should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the layout is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	Underground openings shall be designed and constructed to minimize impacts on underground site characterization. (SDRD 1.2.6.6, Performance Criterion 1) Underground openings within the Topopah Spring and Calico Hills units shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 3)
		The Exploratory Shaft Underground Facility support system should be designed, consistent with the other goals of site characterization, to limit the impacts on isolation. If the support system is determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	Partially	Rock support and other structural anchoring materials used in rock support systems shall be compatible with waste isolation operations and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 4)
		The Exploratory Shaft Underground Facility operational seals should be designed, consistent with other goals of site characterization, to limit impacts on isolation. If the seals are determined to be important to waste isolation a comparative evaluation of alternatives shall be performed	N	
60.21(c) (11)	Site	The pad shall be designed to permit the ground to be restored to a contour compatible with its initial conditions	Y	The design shall include considerations for site restoration. (SDRD 1.2.6.1, Constraint 14)
		The shaft liner shall be designed to be removable prior to permanent closure	Y	Shaft(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2 constraint 2c) Shaft liners may be left in place. (SDRD 1.2.6.9.2, Constraint 2d)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c)(11) (continued)	First shaft	To prevent complications of seal evaluations and emplacement and limit chemical alteration in future seal environments, no pressure grouting shall take place during the construction period of the shaft at locations of potential seal testing or emplacement. Specifically, no pressure grouting shall be performed within 50 feet of the original ground surface and within 50 feet (above and below) the contact of the Pah Canyon and Topopah Spring tuffs	N	
		Furnishings in the shafts shall be designed to be removable, if necessary, prior to permanent closure	Y	Shafts(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2, Constraint 2c)
	Second shaft	Shaft liners shall be designed to be removable prior to permanent closure	Y	Shaft(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2, Constraint 2c) Shaft liners may be left in place. (SDRD 1.2.6.9.2, Constraint 2d)
		To prevent complications of seal evaluations and emplacement and limit chemical alteration in future seal environments, no pressure grouting shall take place during the construction period of the shaft at locations of potential seal testing or emplacement. Specifically, no pressure grouting shall be performed within 50 feet of the original ground surface and within 50 feet (above and below) the contact of the Pah Canyon and Topopah Spring tuffs	N	
		Furnishings in the shafts shall be designed to be removable, if necessary, prior to permanent closure	Y	Shaft(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2, Constraint 2c)
		The drainage plan for the ESF and long exploratory drifts should be consistent with postclosure sealing concerns	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.4, Performance Criterion 6)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
(page 8 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c) (11) (continued)	Underground excavation			<p>Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.5, Performance Criterion 6)</p> <p>Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)</p> <p>Gravity drainage, storage, and pumping systems, with adequate capacity and control measures, shall be designed and constructed for the control and transfer to the surface of underground water to ensure worker protection and to preclude adverse effects on in situ site characterization testing. (SDRD 1.2.6.7.6, Performance Criterion 1)</p>
		Nonpermanent components in the underground openings shall be designed to be removable, if necessary, prior to permanent closure	Y	Facilities shall be removed by the most practicable and cost-effective methods. (SDRD 1.2.6.9.2, Constraint 2)
60.21(c) (11) (continued)	Decommissioning	The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment	Y	<p>Horizontal and vertical drillholes extending from the exploratory shaft(s) and rooms will be sealed. (SDRD 1.2.6.9.2, Constraint 2a)</p> <p>Subsurface drifts and rooms shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2b)</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
(page 9 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.21(c) (11) (continued)	Decommissioning (continued)			Shaft(s) shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2e)
60.74	Underground testing	The testing program and underground layout shall be designed with sufficient flexibility that tests that are deemed appropriate by the NRC can be performed. Prior to incorporating such tests, an evaluation of potential impacts on waste isolation shall be performed	Partially	The size and layout of the openings excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (see Section 1.2.6.0, Performance Criterion 2). (SDRD 1.2.6.6, Performance Criterion 17)
		Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. Prior to incorporating such tests, an evaluation of potential impacts on waste isolation shall be performed	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10)
60.112	Site	The Exploratory Shaft Facility pad shall be designed and constructed so that it does not lead to creation of pathways that compromise the repository's capability to meet the performance objective of 10 CFR Part 60.112	Y	
	Utilities	The surface utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	First shaft	The shaft opening shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objectives of 10 CFR Part 60.112	Y	ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (SDRD 1.2.6.0, Performance Criterion 10)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
(page 10 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.112 (continued)	Second shaft	The shaft opening shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objectives of 10 CFR Part 60.112	Y	ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (SDRD 1.2.6.0, Performance Criterion 10)
	Underground excavation	The Exploratory Shaft Facility underground excavation shall be designed and constructed so that, following permanent closure, it does not become a pathway that compromises the repository's ability to meet the performance objective of 10 CFR Part 60.112	Y	ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (SDRD 1.2.6.0, Performance Criterion 10)
	Underground utilities	The underground utilities shall be designed and constructed so that they do not affect the capability of the repository to meet the Performance Objective of 10 CFR 60.112	N	
	Underground testing	The testing program shall not affect the capability of the underground repository to meet the performance objective of 10 CFR 60.112	Y	Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2)
		Borehole openings shall be designed so that, following permanent closure, they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60.112	Y	ESF openings, boreholes, and their seals shall be designed so that they do not become pathways that compromise the repository's ability to meet the performance objectives of 10 CFR Part 60. Compliance with this criterion will be demonstrated in the license application. (SDRD 1.2.6.0, Performance Criterion 10)
	Decommissioning	The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment	Y	Horizontal and vertical drillholes extending from the exploratory shaft(s) and rooms will be sealed. (SDRD 1.2.6.9.2, Constraint 2a)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.112 (continued)				Subsurface drifts and rooms shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2b)
				Shaft(s) shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2e)
60.113(a) (1) (i)	Underground excavation	The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground utilities	The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground testing	The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period, and construction and operation of the underground testing program shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment and a release of radionuclides that is a gradual process after the containment period	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.113(a) (i) (ii) (A)	Underground excavation	The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground utilities	The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and construction of the underground utilities shall be performed in a manner intended to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground testing	The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository, and implementation and operation of the underground testing program shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure substantially complete containment for a period not less than 300 years nor more than 1000 years after the permanent closure of the repository	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.113(a) (1) (ii) (B)	Underground excavation	The underground excavation shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground utilities	The underground utilities shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction of the underground utilities shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)
	Underground testing	The underground testing program shall be designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure, and construction and operation of the underground excavation shall be performed in a manner designed to assist or not detract from the capability of the repository to ensure that the release of radionuclides does not exceed a rate of one part in 100,000 per year of the inventory of radionuclides calculated to be present at 1000 years following permanent closure	Partially	(This criterion is partially addressed by the lower-level criteria covered later in this table)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130	Site	Pad operation and construction should limit adverse chemical changes by controlling the use of hydrocarbons, solvents, and chemicals	Partially	<p>The ESF system shall comply with all applicable federal environmental regulations and with state and local environmental regulations consistent with the DOE's responsibilities under the Nuclear Waste Policy Act of 1982 (NWPA). Such compliance could include the following:</p> <ul style="list-style-type: none"> a. The designs for systems which contain point-source discharges of treated waste waters into surface-water systems shall comply with the provisions of the Clean Water Act (as amended) as implemented through the National Pollutant Discharge Elimination System (NPDES) permit process. b. The design for the management and disposal of solid and any hazardous wastes (excluding any radioactive wastes) shall be conducted in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA) (as amended) which could include RCRA permitting for the hazardous c. The design for systems which handle, use, and/or dispose of any toxic substances shall comply with the requirements of the Toxic Substances Control Act (TSCA), as amended. Federal regulations implementing TSCA are coded in Title 40, Chapter I, Subchapter R. (SDRD 1.2.6.0, Constraint 1a, b, c)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
First Shaft		Shaft operation and construction should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4) The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24) Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)
		The usage of cement, shotcrete, and grout for bolt anchors or other rock mass support for shaft construction and operations should not exceed requirements for proper construction or safety considerations	Partially	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.4, Constraint 5)
		The chemistry of any water used in shaft construction, or operation should be compatible with post-closure requirements to isolate and contain waste	N	
		Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted	Partially	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.4, Constraint 5) The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	First shaft (continued)			
		A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning	N	The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)
		The capability to enhance postclosure performance by removing shaft liners shall be retained	Y	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)
		The shaft shall be designed with construction controls that enable flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes	Partially	Shaft(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2, Constraint 2c)
				Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.4, Constraint 5)
				The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.4, Constraint 3)
				Shaft permanent structures shall be designed and constructed to withstand the effects of the seismic events as defined in the RIB. (SDRD 1.2.6.4, Constraint 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	First shaft (continued)	Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting	Partially	<p>The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)</p> <p>The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization (SDRD 1.2.6.6, Performance Criterion 24)</p> <p>Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)</p> <p>Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.4, Constraint 5)</p>
	Second shaft	Shaft operation and construction should limit adverse chemical changes (type, quantity, and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals	Partially	<p>The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5, Constraint 4)</p> <p>The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
				Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
		The usage of cement, shotcrete, and grout for bolt anchors or other rock mass support for shaft construction and operations should not exceed requirements for proper construction or safety considerations	Partially	Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.5, Constraint 5)
		The chemistry of any water used in shaft construction, or operation should be compatible with postclosure requirements to isolate and contain waste	N	
		Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5, Constraint 4) The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 2) Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Criterion 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	Second shaft (continued)			Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.5, Constraint 5)
		A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning	N	
		The capability to enhance postclosure performance by removing shaft liners shall be retained	Y	Shaft(s) shall be stripped of equipment and structures. (SDRD 1.2.6.9.2, Constraint 2c)
		The shaft shall be designed with construction controls that enable flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.5, Constraint 2) The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.5, Constraint 3) Shaft permanent structures shall be designed and constructed to accommodate seismic events as defined in the RIB. (SDRD 1.2.6.5, Constraint 14)
		Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5, Constraint 4)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130	Second shaft (continued)			<p>The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)</p> <p>Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)</p> <p>Rock support and other structural anchoring materials shall be compatible with waste isolation and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.5, Constraint 5)</p>
60.130	Underground excavation	<p>The ESF shall be designed with a minimum distance of 75 feet between the centerlines of the adjacent ESF and waste emplacement drifts</p> <p>Underground facility operation and construction should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals</p>	<p>N</p> <p>Partially</p>	<p>The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)</p> <p>The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)</p> <p>Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	Underground excavation (continued)	Underground facility construction and operation should limit cement, shotcrete, and grout for bolt anchors or other rock mass support to that required for proper construction	Partially	Rock support and other structural anchoring materials used in rock support systems shall be compatible with waste isolation operations and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 4)
		The chemistry of any water used in underground excavation construction or operation should be compatible with postclosure requirements to isolate and contain waste	N	
		Fluids and materials planned for use in the underground excavation shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)
				The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)
				Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
				Rock support and other structural anchoring materials used in rock support systems shall be compatible with waste isolation operations and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 4)
		A materials control program should be implemented to enable establishment of limits on the inventory of materials left after decommissioning	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by UAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	Underground excavation (continued)	The underground excavation shall be designed with construction controls that permit flexibility in closure, such as the location of seals, so that a seismic event is unlikely to compromise the ability of the facility to isolate wastes	Partially	Underground openings within the Topopah Spring and Calico Hills units shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 3)
		Construction and operations should be executed in a manner that contributes to or does not detract from isolation capability of the site; for example by limiting organics in drilling fluids, construction materials, and explosive residues from blasting	Partially	Excavation techniques shall control over-break of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.6, Performance Criterion 23) Shaft permanent structures shall be designed and constructed to withstand the effects of the seismic events as defined in the RIB. (SDRD 1.2.6.4, Constraint 13) The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4) The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24) Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1) Rock support and other structural anchoring materials used in rock support systems shall be compatible with waste isolation operations and shall neither interfere with radionuclide containment nor enhance radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 4)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	Underground utilities	Utility systems, including the water distribution and mine wastewater collection systems, shall be designed so that, in the event of seismic activity, the ability of the facility to isolate waste will not be compromised	Partially	The mine wastewater system shall be designed to prevent damage caused by water hammer and other destructive events. (SDRD 1.2.6.7.6, Performance Criterion 4)
	Underground testing	Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use for possible effects on the capability of the site to isolate waste, and appropriate controls instituted	Partially	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1) Testing shall not affect overall site integrity of the Mined Geologic Disposal system as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2)
		The testing program should limit adverse chemical changes (type, quantity and location) particularly to pH and organic content of ground water, by controlling the use of hydrocarbons, solvents, and chemicals	Partially	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)
		The testing program should be executed in a manner that contributes to or does not detract from the isolation capability of the site; for example, by limiting organics in drilling fluids and explosive residues from blasting	Partially	The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24) Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.130 (continued)	Underground testing (continued)	The chemistry of any water used in the testing program should be compatible with isolation and containment objectives	N	Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2)
60.133(a) (1)	First shaft	The shaft configuration (shaft location, shaft diameter, shaft separation, and shaft depth) should contribute to or not detract from the isolation capability of the site	Partially	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.4, Constraint 3)
	Second shaft	The shaft configuration (shaft location, shaft diameter, shaft separation, and shaft depth) should contribute to or not detract from the isolation capability of the site	Partially	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.5, Constraint 3)
	Underground excavation	The underground facility configuration (drift location, orientation, geometry, and drift sizes) should contribute to or not detract from the capability of the site to isolate and contain waste	Partially	The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment. (SDRD 1.2.6.0, Constraint 3) Underground openings within the Topopah Spring and Calico Hills units shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(a) (1) (continued)	Underground excavation (continued)			The design of underground openings and their supports shall utilize pillar and opening geometries that limit stress concentration to acceptable levels. (SDRD 1.2.6.6, Performance Criterion 5)
				Underground excavated areas shall be designed for safe and maintainable ground support and control where required. (SDRD 1.2.6.6, Performance Criterion 9)
		Overburden above the potential repository horizon must be > 200m	Y	The proposed Main Test Level floor within the Topopah Spring Member at the first shaft will be defined as the 1020 level. (SDRD 1.2.6.6, Constraint 2)
		If possible, confine Main Test Level facility to TSM2, although TSM1 can be considered	Y	The proposed Main Test Level floor within the Topopah Spring Member at the first shaft will be defined at the 1020 level. (SDRD 1.2.6.6, Constraint 2)
		Location of underground facility should stay within the conceptual perimeter drift boundary, except as needed to characterize areas outside that boundary, taking into account any potential impacts on the waste isolation capabilities of the site	Y	Targets to be utilized in the design and construction of the underground drifts can be found on Sketch Number 5, Appendix A. (SDRD 1.2.6.6, Constraint 4)
		The distance of underground facility openings from exploratory boreholes drilled from the surface should be at least 15m	N	
		The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening, and considering the closest proximity of any part of each opening)	N	
		The number of interconnections between the dedicated test area and the repository should be limited to as few as possible, consistent with access and ventilation needs	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(a) (1) (continued)	Underground excavation (continued)	The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)
60.133(a) (2)	Site	The areas around the shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood	Y	The shafts and shaft collar areas shall be located and/or graded to protect them from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.1, Performance Criterion 5) The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2) The main pad shall be designed to handle potential runoff in the existing natural drainage channels from a probable maximum flood. (SDRD 1.2.6.1.1, Performance Criterion 1)
	Utilities	Water storage tanks should be located, or protection provided to preclude water inflow to ESF following a possible tank failure	Partially	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint #2)
		Piping shall be designed to preclude or limit possible water inflow to the ESF following a pipe rupture	Partially	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint #2)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(a)(2) (continued)	First shaft	The exploratory shaft shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint #2)
	Second shaft	The exploratory shaft shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint #2)
	Underground excavation	The Exploratory Shaft Underground Facility shall be designed so that the effects of credible disruptive events (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)
		The drainage plan for the ESF and long exploratory drifts should be designed to ensure that the effects of flooding shall be limited from spreading through the facility	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)
		Materials should be selected such that effects of fire do not produce geochemical effects that impact waste isolation capabilities of the site	Partially	To the extent practicable, the ESF shall be designed to incorporate the use of noncombustible and heat-resistant materials
		The underground facility should be designed to limit any spread of fire, which could produce geochemical effects that impact waste isolation capabilities of the site	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDR) (page 28 of 71)

Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
MRC CONCERN 1 (CONTINUED)				
60.133(a) (2)	Underground excavation (continued)	Operational seals shall be provided where necessary to control the spread of water through the facility	Partially	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)
	Underground utilities	Water lines in ESF should be outfitted to limit water inflow to ESF following a possible line rupture	Partially	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)
		Effective redundant minewater discharge systems should be provided to limit possible impacts on the isolation capability of the site	Y	The mine wastewater system shall have full operating redundancy, or storage capacity to allow installation of spares. (SDRD 1.2.6.7.6, Performance Criterion 3)
		Fire suppression agents shall be selected such that they do not produce geochemical effects that adversely impact waste isolation capabilities of the site	Y	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
60.133(b)	Underground excavation	The ESF should be designed so as not to interfere with the flexibility of the repository to accommodate specific site conditions	Partially	Provide compatibility with the repository conceptual design so that the test level development does not adversely impact future repository development Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference																						
NRC CONCERN 1 (CONTINUED)																										
60.133(b) (continued)	Underground excavation (continued)			<p>determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule, test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems:</p> <table><thead><tr><th>Description</th><th>Uncertainty Allowance</th></tr></thead><tbody><tr><td>Underground test area at the main test level</td><td>100 percent</td></tr><tr><td colspan="2">Systems</td></tr><tr><td>- Site</td><td></td></tr><tr><td>- Utilities</td><td>DETERMINED BY</td></tr><tr><td>- Surface facilities</td><td>ANALYSES IN THE</td></tr><tr><td>- First shaft</td><td>TITLE I DESIGN PHASE</td></tr><tr><td>- Second shaft</td><td></td></tr><tr><td>- Underground excavations</td><td></td></tr><tr><td>- Underground utility systems</td><td></td></tr><tr><td>- Underground tests</td><td></td></tr></tbody></table> <p>Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)</p>	Description	Uncertainty Allowance	Underground test area at the main test level	100 percent	Systems		- Site		- Utilities	DETERMINED BY	- Surface facilities	ANALYSES IN THE	- First shaft	TITLE I DESIGN PHASE	- Second shaft		- Underground excavations		- Underground utility systems		- Underground tests	
Description	Uncertainty Allowance																									
Underground test area at the main test level	100 percent																									
Systems																										
- Site																										
- Utilities	DETERMINED BY																									
- Surface facilities	ANALYSES IN THE																									
- First shaft	TITLE I DESIGN PHASE																									
- Second shaft																										
- Underground excavations																										
- Underground utility systems																										
- Underground tests																										
		The number of interconnections between the dedicated test area and the repository should be limited to as few as practicable	N																							

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(b) (continued)	Underground excavation (continued)	The area of the ESF underground excavations shall be limited to that necessary for conducting the needed site characterization and performance confirmation tests	Partially	<p>The ESF shall be designed to support site characterization by providing facilities to meet the needs of in situ site characterization testing. (SDRD 1.2.6.0, Performance Criterion 1)</p> <p>Provide underground openings in welded and nonwelded tuff for in situ site characterization construction, operations, and maintenance. (SDRD 1.2.6.6, Functional Requirements)</p> <p>The size and layout of the opening excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (See Section 1.2.6.0, Performance Criterion 2) (SDRD 1.2.6.6, Performance Criterion 17)</p>
60.133(d)	Site	<p>The amount of water used in construction, and operations, of the main pad should be limited so as to limit the effects on the containment and isolation capability of the site</p> <p>Water use in pad construction shall not adversely impact goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to 90%</p> <p>Construction of the main pad shall be performed in a manner to avoid blockage of natural surface water drainageways and avoid creation of surface water impoundments that could impact postclosure performance</p>	<p>N</p> <p>N</p> <p>Partially</p>	<p>The main pad shall be designed to handle potential runoff in the existing natural drainage channels from a probable maximum flood. (SDRD 1.2.6.1.1, Performance Criterion 1)</p> <p>The shafts and shaft collar areas shall be located and/or graded to protect them from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.1, Performance Criterion 5)</p>

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Site (continued)	MPBHs or other surface drilled exploratory boreholes associated with the ESF shall be drilled dry	Partially	Dry air coring will be required for some tests. (SDRD 1.2.6.1, Performance Criterion 5)
		MPBHs shall incorporate a standpipe or other measures appropriate and adequate for protection against the effects of maximum credible floods during the period when MPBHs are accessible prior to borehole plugging and sealing	Partially	The shafts and shaft collar areas shall be located and/or graded to protect them from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.1, Performance Criterion 5)
		Construction water shall be limited to that required for dust control and proper equipment operation consistent with performance objectives	Partially	Dust control shall be provided at potential dust-generation areas such as roads and earth moving sites in order to minimize airborne particles, as required by federal, state, and local codes. (SDRD 1.2.6.1, Performance Criterion 4)
		Construction procedures shall enable removal of excess water	N	The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)
	Utilities	Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance	Partially	
		Fluids recovered from sanitary uses or during construction operations should be disposed of in such a way as to avoid potential for performance impacts, for example in lined ponds	Y	Sanitary wastes will be disposed of by means of collection piping from all buildings and trailers to a sanitary waste disposal system located east of the ESF a minimum of 400 feet beyond the perimeter of the proposed repository subsurface facility to prevent interference with site characterization activities. See Appendix A, Conceptual Sketch number 2. (SDRD 1.2.6.2.3, Performance Criterion 1)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Utilities (continued)			A suitable mine wastewater system shall be provided for collection, pumping, and disposing of expected water and credible water inflows. The system shall be designed to pump all of the collected water to the surface, collect it on the surface, and pump it offsite for disposal. (SDRD 1.2.6.2.5, Performance Criterion 2)
	First Shaft	The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site	Y	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)
		Water use in shaft construction should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas	N	
		The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1, and drainage in long drifts should be compatible with repository grades	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.4, Performance Criterion 6)
				Water handling and control in the shaft shall be sized for credible water inflows. (SDRD 1.2.6.4, Performance Criterion 13)
				Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)
				(this criterion should be included in "underground excavation")

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	First shaft (continued)	The shafts should be separated to maintain reasonable distances for power and instrument cabling and water piping as well as to provide for redundancy in mine water discharge	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, as defined by the Nevada Coordinate System. (SDRD 1.2.6.4, Constraint 9)
				The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918. (SDRD 1.2.6.5, Constraint 10)
		Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal	Y	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.5, Performance Criterion 6)
		Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance	Partially	All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7)
				The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)
		Construction water shall be limited to that required for dust control and proper equipment operation	Partially	Dust control shall be provided at potential dust-generation areas such as roads and earth moving sites in order to minimize airborne particulates, as required by federal, state, and local codes. (SDRD 1.2.6.1, Performance Criterion 4)
				The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumptions 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	First shaft (continued)	Construction procedures shall enable removal of excess water	N	
		Operational seals shall be provided where necessary to control the intrusion of water into the facility	N	
	Second shaft	The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site	Y	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5, Constraint 4)
				Structures, systems, and components shall be provided for effective water and ground control. (SDRD 1.2.6.5, Performance Criterion 5)
				The use of water in the development of underground opening shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)
		Water use in shaft construction should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas	N	
		The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.5, Performance Criterion 6)
				Water handling and control in the shaft shall be sized for credible water inflows. (SDRD 1.2.6.5, Performance Criterion 15)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Second shaft (continued)	<p>Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal</p> <p>Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance</p> <p>Construction water shall be limited to that required for dust control and proper equipment operation consistent with performance goals</p>	<p>Y</p> <p>Partially</p> <p>Partially</p>	<p>Appropriate gravity drainage and/or pumping systems shall be incorporated in underground opening for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)</p> <p>Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.4, Performance Criterion 6)</p> <p>All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7)</p> <p>The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)</p> <p>Dust control shall be provided at potential dust-generation areas such as roads and earth moving sites in order to minimize airborne particulates, as required by federal, state, and local codes. (SDRD 1.2.6.1, Performance Criterion 4)</p> <p>The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)</p>

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Second shaft (continued)	Construction procedures shall enable removal of excess water	N	
		Operational seals shall be provided where necessary to control the intrusion of water into the facility	N	
	Underground excavation	The amount of water used in construction and operations, should be limited so as to limit the effects on the containment and isolation capability of the site	Y	The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6 Assumption 3)
		Water used in construction and operations should not adversely impact the repository design goals to limit the average saturation of the repository horizon to <75% and limit local saturation to <90% in areas of waste emplacement	N	
		The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and postclosure sealing concerns. Specifically, drainage in the dedicated test area should be toward ES-1 and drainage in long drifts should be compatible with repository grades	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)
		Construction and operating water shall be limited to that required for dust control and proper equipment operation consistent with performance goals	Y	Dust control shall be provided at potential dust-generation areas such as roads and earth moving sites in order to minimize airborne particulates, as required by federal, state, and local codes. (SDRD 1.2.6.1, Performance Criterion 4) The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDPD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Underground excavation (continued)	Construction procedures shall enable removal of excess water	N	All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7) The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)
		Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal	Y	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18)
		Operating procedures shall be developed to ensure water entering the ESF is managed appropriately, including quantity, location and water balance	Partially	
	Underground utilities	Operational seals shall be provided where necessary to control the intrusion of water into the facility	N	
		Appropriate gravity drainage and/or pumping systems shall be incorporated into the shaft and underground facilities for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal	Y	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. (SDRD 1.2.6.6, Performance Criterion 18).
		The groundwater collection and control system shall be designed to include possible inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development, in addition to expected inflows	Y	The groundwater collection and control system shall be designed to include inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development. (SDRD 1.2.6.7.6, Performance Criterion 6)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.13(d) (continued)	Underground utilities (continued)	The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, or a steady flow of 20 GPM	Y	The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM. (SDRD 1.2.6.7.6, Performance Criterion 7)
	Underground testing	The amount of water used in testing and operations, should be limited so as to limit the effects on the containment and isolation capability of the site	Partially	All water used during operation and construction of the ESF shall be provided with chemical tracers as required by testing. (SDRD 1.2.6.7.5, Constraint 1) Water handling and control in the shaft shall be sized for credible water inflows. (SDRD 1.2.6.4, Performance Criterion 13) The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)
		Water use in testing should be generally consistent with repository design goals to limit the average saturation of the repository horizon to <75% and limit the local saturation to <90% in waste emplacement areas	N	
		MPBHs or other surface drilled exploratory boreholes associated with the ESF shall be drilled dry	Partially	Dry air coring will be required for some tests. (SDRD 1.2.6.6, Performance Criterion 13)
		Testing water should be limited to that required for dust control and proper test operation consistent with performance goals	Partially	The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(d) (continued)	Underground testing (continued)	Testing procedures shall require removal of excess water	N	
		Any cleaning of ESF walls to facilitate photography, mapping, or other testing shall be done using compressed air/mist using control procedures	N	
		Test procedures must be developed to ensure water entering the ESF is managed appropriately, including quantity, location, and water balance	Partially	All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7) The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)
		Gaseous products used in characterization should not produce geochemical effects that impact waste isolation capabilities of site	N	
60.133(e) (2)	First shaft	The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration	Y	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.4, Constraint 3)
		An adequate distance between shafts should be provided to reduce potential mechanical interference between the two shafts	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. (SDRD 1.2.6.4, Constraint 9) The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918. (SDRD 1.2.6.5, Constraint 10)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(e) (2) (continued)	Second shaft	The shaft should be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration	Y	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.5, Constraint 3)
		An adequate distance between shafts should be provided to reduce potential mechanical interference between the two shafts	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. (SDRD 1.2.6.4, Constraint 9)
	Underground excavation			The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918. (SDRD 1.2.6.5, Constraint 10)
		The underground excavation be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration	Y	Underground openings within the Topopah Spring and Calico Hills units shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.6, Performance Criterion 3)
		The design of underground openings and their supports shall utilize pillar and opening geometries that limit stress concentration to acceptable levels, so as to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration	Y	The design of underground openings and their supports shall utilize pillar and opening geometries that limit stress concentration to acceptable levels. (SDRD 1.2.6.6, Performance Criterion 5)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(e) (2) (continued)	Underground excavation (continued)	The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening, and considering the closest proximity of any part of each opening)	N	
		The ESF shall be designed to be consistent with the repository design goal to limit the extraction ratio to less than 30%	N	
60.133(f)	Site	Excavation techniques used for pad construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass	Y	The design and construction of the site (civil improvements) for the permanent ESF structures, systems, and components shall not significantly increase the preferential pathways for groundwater or radioactive waste migration to the accessible environment. (SDRD 1.2.6.1, Constraint 1)
	First shaft	The exploratory shaft construction method should be selected, consistent with other goals of site characterization, to limit impacts on isolation	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.4, Constraint 2)
		Excavation techniques used for shaft and station construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass	Y	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.4, Constraint 2)
		Drill and blast specifications should include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.4, Constraint 2)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDPD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(f) (continued)	First shaft (continued)	The excavation methods should be compatible with repository design goals to limit permeability changes beyond 3 m from the walls of the excavation to less than one order of magnitude	N	
		The exploratory shaft construction method should be selected, consistent with other goals of site characterization, to limit impacts on isolation	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.5, Constraint 2)
		Excavation techniques used for shaft and station construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass	Y	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.5, Constraint 2)
		Drill and blast specifications should include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.5, Constraint 2)
	Underground excavation	The excavation methods should be compatible with repository design goals to limit permeability changes beyond 3 m from the walls of the excavation to less than one order of magnitude	N	
		Excavation techniques used for ESF construction shall control overbreak of rock and limit disturbance to the integrity of the adjoining rock mass	Y	Excavation techniques shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.6, Performance Criterion 23)
		Drill and blast specifications shall include controls related to types and amounts of explosives, shot patterns, and hole depth in order to limit the magnitude and extent of blast-induced permeability	Partially	Excavation techniques shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.6, Performance Criterion 23)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(h)	First shaft	Engineered barriers in the shafts shall assist the geologic setting in limiting the release of radionuclides to the accessible environment	N	
	Second shaft	Engineered barriers in the shafts shall assist the geologic setting in limiting the release of radionuclides to the accessible environment	N	
	Underground excavation	The engineered barriers in the underground excavation must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment.	Y	The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment. (SDRD 1.2.6.0, Constraint 3)
		The engineered barriers in the underground excavation shall not preclude the repository from creating a waste package environment that favorably controls chemical reactions affecting waste package performance	Partially	The engineered barrier system must be designed such that other systems, structures, and components of the ESF and the candidate repository do not eventually become ground-water flow paths and do not promote the release of radionuclides to the accessible environment. (SDRD 1.2.6.0, Constraint 3)
	Decommissioning	The first shaft, second shaft, all underground excavations, and all boreholes shall be constructed to allow backfilling and sealing as necessary to limit the release of radioactive material to the environment	Y	Horizontal and vertical drillholes, extending from the exploratory shaft(s) and rooms will be sealed. (SDRD 1.2.6.9.2 Constraint 2a) Subsurface drifts and rooms shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2b) Shaft(s) shall be backfilled with the material that was removed during excavation and/or with other suitable engineered material. (SDRD 1.2.6.9.2, Constraint 2e)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(1)	First shaft	The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads	Y	The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date. (SDRD 1.2.6.4.2, Performance Criterion 1)
	Second shaft	The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads	Y	The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date. (SDRD 1.2.6.5.2, Performance Criterion 1)
	Underground excavation	The ESF shall be designed, taking into account the predicted thermal and thermomechanical response of the host rock and surrounding strata so that the performance objectives of the repository can be met	Y	The predicted thermal and thermo-mechanical response of the host rock and surrounding strata, and the groundwater system shall be considered in the ESF design. (SDRD 1.2.6.0, Constraint 8)
		The ESF shall be designed such that the thermal and thermomechanical effects of ESF operations and testing do not produce failure of intact rock, nor gross rock mass failure, along potential pathways from the repository to the accessible environment	Y	The predicted thermal and thermo-mechanical response of the host rock and surrounding strata, and the groundwater system shall be considered in the ESF design. (SDRD 1.2.6.0, Constraint 8)
		The ESF shall be designed so that the thermal and thermomechanical effects of ESF operations and testing on the groundwater system, do not significantly increase the saturation of the host rock in the waste emplacement area	Y	The predicted thermal and thermo-mechanical response of the host rock and surrounding strata, and the groundwater system shall be considered in the ESF design. (SDRD 1.2.6.0, Constraint 8)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.133(i)	Underground excavation (continued)	The underground excavation support system shall be designed to withstand pressures under anticipated conditions, including reaction to thermally induced stresses resulting from thermal loads	Partially	The shaft liner shall withstand pressures exerted along its length and around the entire perimeter under anticipated conditions, including reaction to thermally induced stresses as defined in the RIB. The provisions for thermally induced stresses can be installed at a later date. (SDRD 1.2.6.4.2, Performance Criterion 1)
	Underground testing	The ESF shall be designed such that the thermal and thermomechanical effects of ESF testing does not produce failure of intact rock, nor gross rock mass failure, along potential pathways from the repository to the accessible environment	Y	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)
		The ESF shall be designed so that the thermal and thermomechanical effects of ESF testing on the groundwater system, do not significantly increase the saturation of the host rock in the waste emplacement area	Partially	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)
		The ESF shall be designed so that the thermal effects of ESF testing do not result in temperatures in excess of 115°C in either TSM3 or CHN units	N	The predicted thermal and thermomechanical response of the host rock and surrounding strata, and the ground-water system shall be considered in the ESF design. (SDRD 1.2.6.0, Constraint 8)
60.137	Underground excavation	The underground excavations shall be designed to accommodate the performance confirmation tests required by 60.141 and 60.142, and taking into account any potentially adverse impacts these excavations could have on the waste isolation capabilities of the site	Partially	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 1 (CONTINUED)				
60.137 (continued)	Underground testing	The testing program shall accommodate the performance confirmation tests required by 60.141 and 60.142, and taking into account any potentially adverse impacts these tests could have on the waste isolation capabilities of the site	Y	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10) Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1) Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2)
60.140 (d)	Underground testing	The design of the performance confirmation testing program shall incorporate aspects specifically directed at limiting the potential for adverse impacts on the long term performance of the repository, and implementation of the performance confirmation testing program and operation of the facility shall be performed in a manner that limits the potential for adverse impacts on the long term performance of the repository	Y	Testing shall not affect overall site integrity of the Mined Geologic Disposal System as required by 10 CFR 60.112. (SDRD 1.2.6.8, Constraint 2) Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10)
60.74	First shaft	The structures, systems, components and operation of the exploratory shafts shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation	Y	Shaft design and construction shall provide for design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4 Performance Criterion 11)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2				
60.74 (continued)	Second shaft	The structures, systems, components and operation of the exploratory shafts shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation	Y	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5 Performance Criterion 12)
	Underground excavation	The dedicated test area should include adequate allowance for additional testing that may be required by the NRC	Y	The size and layout of the openings excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (see Section 1.2.6.0 Performance Criteria item #2.). (SDRD 1.2.6.6 Performance Criterion 17)
		The dedicated test area shall be designed to support such additional testing as may be required by the NRC without disruption of or interference with testing in progress or planned testing	Y	Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule, test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems:

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.74 (continued)	Underground excavation (continued)			<p><u>Description</u> <u>Uncertainty Allowance</u></p> <p>Underground test area at the main test level 100 percent</p> <p>Systems</p> <ul style="list-style-type: none"> - Site - Utilities - Surface facilities - First shaft - Second shaft - Underground excavations - Underground utility systems - Underground tests <p style="text-align: right;">DETERMINED BY ANALYSES IN THE TITLE I DESIGN PHASE</p> <p>Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)</p>
	Underground utilities	The structures, systems, components, and operation of the shaft breakouts and main test level of the ESF shall be designed to accommodate additional tests that may be required by the NRC for site characterization and performance confirmation	Y	<p>Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule, test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference																						
NRC CONCERN 2 (CONTINUED)																										
60.74 (continued)	Underground utilities (continued)			critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems:																						
				<table><tr><th>Description</th><th>Uncertainty Allowance</th></tr><tr><td>Underground test area at the main test level</td><td>100 percent</td></tr><tr><td>Systems</td><td></td></tr><tr><td>- Site</td><td></td></tr><tr><td>- Utilities</td><td>DETERMINED BY</td></tr><tr><td>- Surface facilities</td><td>ANALYSES IN THE</td></tr><tr><td>- First shaft</td><td>TITLE I DESIGN PHASE</td></tr><tr><td>- Second shaft</td><td></td></tr><tr><td>- Underground excavations</td><td></td></tr><tr><td>- Underground utility systems</td><td></td></tr><tr><td>- Underground tests</td><td></td></tr></table>	Description	Uncertainty Allowance	Underground test area at the main test level	100 percent	Systems		- Site		- Utilities	DETERMINED BY	- Surface facilities	ANALYSES IN THE	- First shaft	TITLE I DESIGN PHASE	- Second shaft		- Underground excavations		- Underground utility systems		- Underground tests	
Description	Uncertainty Allowance																									
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- Site																										
- Utilities	DETERMINED BY																									
- Surface facilities	ANALYSES IN THE																									
- First shaft	TITLE I DESIGN PHASE																									
- Second shaft																										
- Underground excavations																										
- Underground utility systems																										
- Underground tests																										
				Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)																						
	Underground testing	The underground test program shall be designed to accommodate the requirements of 10 CFR Part 60.74	Partially	The development of the underground testing program at the ESF has been based upon the qualitative derivation of information needs to satisfactorily address key issues in the Issues Hierarchy. The number of tests may change as site characterization proceeds and more variable or unexpected conditions are encountered. See Section 1.2.6.0, Performance Criteria item #2. (SDRD 1.2.6.8 Assumption 2)																						

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.74 (continued)	Underground testing (continued)	The testing program shall be designed to be able to accommodate additional testing that may be deemed appropriate by the Commission	Partially	The development of the underground testing program at the ESF has been based upon the qualitative derivation of information needs to satisfactorily address key issues in the Issues Hierarchy. The number of tests may change as site characterization proceeds and more variable or unexpected conditions are encountered. See Section 1.2.6.0, Performance Criteria item #2. (SDRD 1.2.6.8 Assumption 2)
		Prior to initiation of additional tests requested by the Commission, an analysis of the potential for the tests to affect the ability of the site to be characterized shall be performed	N	
60.130	First Shaft	Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected (SDRD 1.2.6.4, Constraint 4) The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization (SDRD 1.2.6.6, Performance Criterion 24) Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
	Second Shaft	Fluids and materials planned for use in the shaft shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented	Partially	The use of blasting agents, explosives and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5, Constraint 4)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.130 (continued)	Second shaft (continued)		Partially	The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Constraint 24)
			Partially	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
	Underground excavation	Fluids and materials planned for use in the ESF underground facility shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented	Partially	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4, Constraint 4)
			Partially	The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization. (SDRD 1.2.6.6, Performance Criterion 24)
			Partially	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8, Constraint 1)
			Partially	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas.
	Underground testing	Fluids and materials planned for use in testing in the ESF shall be evaluated with respect to intended use and possible effects on site characterization or other testing, and appropriate controls will be implemented		

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(a) (2)	Site	The areas around the shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood such that testing in the underground portion of the ESF is not adversely affected	Y	The shafts and shaft collar areas shall located and/or graded to protect them from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.1 Performance Criterion 5)
	First Shaft	The exploratory shaft collar shall be designed to prevent significant water inflow from a maximum credible flooding event during site characterization and the planned period of repository operation, such that testing in the underground portion of the ESF is not adversely affected	Y	Shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.4.1 Performance Criterion 1)
	Second shaft	The exploratory shaft collar shall be designed to prevent significant water inflow from a maximum credible flooding event during site characterization and the planned period of repository operation, such that testing in the underground portion of the ESF is not adversely affected	Y	Shaft collar shall be designed and constructed to prevent water inflow from the probable maximum flood as defined in the RIB. (SDRD 1.2.6.5.1 Performance Criterion 1)
	Underground excavation	The Exploratory Shaft Underground Facility shall be designed so that the effects of credible disruptive events shall be limited from spreading through the facility and affecting characterization	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0 Constraint 2)
		The drainage plan for the ESF and long exploratory drifts should be designed to ensure that the effects of flooding shall be limited from spreading through the facility and affecting characterization	Y	The ESF shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0 Constraint 2)
		The presence of combustible materials in the underground facility shall be controlled and limited such that testing in the ESF is not adversely affected	Y	To the extent practicable, the ESF shall be designed to incorporate the use of non-combustible and heat-resistant materials. (SDRD 1.2.6.0 Constraint 7)
	Underground utilities	The ESF shall have redundant mine water discharge systems to control and limit the impact of water intrusion on testing in the ESF	Y	The mine wastewater system shall have full operating redundancy, or storage capacity to allow installation of spares. (SDRD 1.2.6.7.6 Performance Criterion 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(a) (2) (continued)	Underground utilities (continued)	The underground portion of the ESF shall incorporate a fire protection system to control and limit the impact of a credible fire on testing in the ESF	Y	Suppression agents shall be selected for their compatibility with their intended use. These agents shall be approved for use based on their impacts on underground safety and the in situ site characterization testing program. (SDRD 1.2.6.7.8 Constraint 1)
		The underground utility system shall be designed to control and limit the impact of utility system failures caused by credible disruptive events such as fire, explosion, or seismic events, on site characterization and other testing	Partially	The ESF Shall be designed so that the effects of credible disruptive events as defined in the RIB (e.g., flooding, fires, and explosions) shall be limited from spreading through the facility. (SDRD 1.2.6.0, Constraint 2)
	Underground Utilities (continued)	The mine water collection, control, and removal system shall be designed with capacity for emergency situations such as unexpected inflow or water line breakage, inflow from penetrations of fault structures during drifting, or from perched water encountered during shaft sinking and ESF development, such that the capability to adequately characterize the site is maintained	Y	The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM. (SDRD 1.2.6.7.6, Performance Criterion 7)
				Gravity drainage, storage, and pumping systems, with adequate capacity and control measures, shall be designed and constructed for the control and transfer to the surface of underground water to ensure worker protection and to preclude adverse effects on in situ site characterization testing. (SDRD 1.2.6.7.6 Performance Criterion 1)
				The groundwater collection and control system shall be designed to include inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development. (SDRD 1.2.6.7.6 Performance Criterion 6)
				The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM (SDRD 1.2.6.7.6 Performance Criterion 7)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(b)	First shaft	The configuration of the shaft shall be adequate to support site characterization testing, and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing	Y	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4 Performance Criterion 11) [Allowance for additional testing needs to be included]
		The design of ES-1 shall include flexibility to deepen the shaft to at least 1,500 feet, or approximately 100' deeper than the Topopah Spring/Calico Hills unit contact, without adversely affecting other testing that may be ongoing. Such flexibility shall consider aspects of hoisting capacity, underground utilities, ground support, and muck handling	Y	
	Second shaft	The configuration of the shaft shall be adequate to support site characterization testing, and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing	Y	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5 Performance Criterion 12) [Allowance for additional testing needs to be included]
	Underground excavation	The ESF shall be designed so that testing areas are separated from possible repository shop, training, operations, or waste emplacement areas, to limit adverse effects from activities in these areas on future testing, including performance confirmation, in the dedicated test area	Y	The openings required for rock handling and for support facilities (e.g., maintenance shops, electrical substations, pump stations, refuge chambers, lunch rooms, and storage facilities for supplies and consumables) shall be located away from in situ site characterization testing to minimize interruptions (SDRD 1.2.6.6.1 Performance Criterion 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(b) (continued)	Underground excavation (continued)	<p>The design of the shaft breakouts and main test level of the ESF shall: (1) limit the extent of interference between tests and (2) limit interference between ESF construction and operation activities and testing activities</p> <p>The design of the shaft breakouts and main test level shall have sufficient flexibility to: (1) relocate experiments as necessary to limit interference between tests and aid in ensuring that test location acceptance criteria are met, (2) incorporate additional tests, as needed, in the dedicated test area, (3) allow development and testing in other areas as needed (e.g. southern portion of repository block or Calico Hills Tuff), and (4) accommodate schedule changes as needed</p> <p>A contingency plan shall be established for underground excavation to accommodate unexpected or site specific conditions that may be encountered, such as highly fractured zones, lithophysae-rich zones, perched water, or pathways for significant water movement</p> <p>The ESF underground excavation shall be of adequate size to support site characterization testing and future testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the dedicated test area, and capacity to extend an exploratory drift from the main test level, if necessary, up to approximately 10,000 feet to other parts of the repository block</p>	<p>Y</p> <p>Partially</p> <p>N</p> <p>Partially</p>	<p>The openings required for rock handling and for support facilities (e.g., maintenance shops, electrical substations, pump stations, refuge chambers, lunch rooms, and storage facilities for supplies and consumables) shall be located away from in situ site characterization testing to minimize interruptions (SDRD 1.2.6.6.1 Performance Criterion 1)</p> <p>[Should also minimize interference]</p> <p>Test areas shall be separated so they are not affected by the excavation disturbed zone, geotechnical edge effects, thermal, mechanical, chemical, and hydrological interactions. (SDRD 1.2.6.6.2 Constraint 1)</p> <p>ESF structures, systems, components, and operations must accommodate additional tests and monitoring if required (see Section 1.2.6.0, Performance Criteria item #2). (SDRD 1.2.6.6.2 Performance Criterion 2) [Criterion needs to be more specific]</p> <p>The size and layout of the openings excavated on the test levels shall be adequate for in situ site characterization needs and capable of supporting additional excavation beyond the initially planned test areas (see Section 1.2.6.0 Performance Criteria item #2) (SDRD 1.2.6.6 Performance Criterion 17)</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference																						
NRC CONCERN 2 (CONTINUED)																										
60.133(b) (continued)	Underground utilities	The design of underground utilities for the ESF shall be capable of supporting expansion of the main test level for additional testing and an exploratory drift from the main test level, if necessary, up to approximately 10,000 feet to other parts of the repository block	Partially	Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule, test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems: <table><tr><th>Description</th><th>Uncertainty Allowance</th></tr><tr><td>Underground test area at the main test level</td><td>100 percent</td></tr><tr><td colspan="2">Systems</td></tr><tr><td>- Site</td><td></td></tr><tr><td>- Utilities</td><td></td></tr><tr><td>- Surface facilities</td><td>DETERMINED BY ANALYSES IN THE</td></tr><tr><td>- First shaft</td><td>TITLE I DESIGN PHASE</td></tr><tr><td>- Second shaft</td><td></td></tr><tr><td>- Underground excavations</td><td></td></tr><tr><td>- Underground utility systems</td><td></td></tr><tr><td>- Underground tests</td><td></td></tr></table>	Description	Uncertainty Allowance	Underground test area at the main test level	100 percent	Systems		- Site		- Utilities		- Surface facilities	DETERMINED BY ANALYSES IN THE	- First shaft	TITLE I DESIGN PHASE	- Second shaft		- Underground excavations		- Underground utility systems		- Underground tests	
Description	Uncertainty Allowance																									
Underground test area at the main test level	100 percent																									
Systems																										
- Site																										
- Utilities																										
- Surface facilities	DETERMINED BY ANALYSES IN THE																									
- First shaft	TITLE I DESIGN PHASE																									
- Second shaft																										
- Underground excavations																										
- Underground utility systems																										
- Underground tests																										

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
60.133(b) (continued)	Underground utilities (continued)			Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)
		The underground utilities for the ESF shall not preclude monitoring and investigation of in situ conditions, and shall be designed to accommodate site specific conditions, construction, and operation of the ESF	N	
60.133(d)	First shaft	The amount of water used in the construction and operation of the shaft should be limited to preclude interference with tests	Y	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.4 Constraint 4)
		Shaft construction and operating procedures shall require the removal of excess water to preclude interference with tests	N	
		The shafts should be separated to maintain reasonable distances for power and instrument cabling and water piping as well as to provide for redundancy in mine water discharge to preclude interference with tests	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. (SDRD 1.2.6.4, Constraint 9)
			Partially	The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918. SDRD 1.2.6.5, Constraint 10)
	Second shaft	The amount of water used in the construction and operation of the shaft should be limited to preclude interference with tests	Y	The use of blasting agents, explosives, and water shall be controlled so that in situ site characterization is not adversely affected. (SDRD 1.2.6.5 Constraint 4)
		Shaft construction and operating procedures shall require the removal of excess water to preclude interference with tests	N	

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(d) (continued)	Underground excavation	The amount of water used in construction and operations of the underground facility should be limited to preclude interference with tests	Y	The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6 Assumption 3)
		Underground facility construction and operating procedures shall require the removal of excess water to preclude interference with tests	N	
		The drainage plan for the ESF and long exploratory drifts should be consistent with repository operations and not impact the capability to characterize the site. Specifically, drainage in the dedicated test area should be toward ES-1 and that in long drifts should be compatible with repository grades	Partially	Appropriate gravity drainage and/or pumping systems shall be incorporated in underground openings for draining water away from testing and other working areas to suitable collection point(s) for further treatment and/or disposal. SDRD 1.2.6.6, Performance Criterion 18)
		Construction methods shall be designed and implemented so that the effects of fluids, gases, or other materials used do not adversely affect the adequacy or reliability of information from site characterization	Partially	The chemical content of the blasting agents and explosives shall be controlled to preclude adverse effects on in situ site characterization (SDRD 1.2.6.6 Performance Criterion 24)
		Methods for dust control and cleaning of walls in the underground portion of the ESF shall be designed to limit adverse effects on the adequacy and reliability of information from site characterization	N	
		Fluids, gases, and other materials used in ESF construction and operations, and/or injected into the rock mass, shall be appropriately tagged. Selection of tracers shall consider, but not be limited to: (1) the possible future need to account for the mobility and disposition of all such materials as part of site characterization, and (2) the effects of tracers on site characterization	Partially	All water used during operation and construction of the ESF shall be provided with chemical tracers are required by testing. (SDRD 1.2.6.7.5, Constraint 1) All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7) The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(d) (continued)	Underground excavation (continued)			Monitoring of conditions such as noise, noxious or flammable gas, and radon shall be conducted in accordance with applicable federal, state, and local regulations. (SDRD 1.2.6.0, Performance Criterion 9)
	Underground utilities	The mine water collection, control, and removal system shall be designed to accommodate inflow from penetrations of fault structures during drifting, or from perched water encountered during shaft sinking and ESF development such that the capability to adequately characterize the site is maintained. The mine water control system shall be designed with capacity for emergency situations such as unexpected inflow or water line breakage	Y	Gravity drainage, storage, and pumping systems, with adequate capacity and control measures, shall be designed and constructed for the control and transfer to the surface of underground water to ensure worker protection and to preclude adverse effects on in situ site characterization testing. (SDRD 1.2.6.7.6 Performance Criterion 1) The groundwater collection and control system shall be designed to include inflow from penetrations of fault structures during geologic drifting or from perched water horizons during shaft sinking and facility development. (SDRD 1.2.6.7.6 Performance Criterion 6) The storage and pumping system shall be designed to provide the capacity to handle emergency situations such as unexpected inflow of water or water line breakage at a peak rate of 250 GPM, steady flow 20 GPM. (SDRD 1.2.6.7.6 Performance Criterion 7)
		The design of the ESF underground utility system, including ventilation, shall facilitate monitoring of moisture influx to the ESF from the rock mass and from ventilation, and moisture efflux from mine water removal and ventilation exhaust to limit possible impacts on the capability to adequately characterize the site	Y	Ventilation provided to and from the underground working areas shall be monitored for radon, methane, oxygen, carbon dioxide, nitrous oxides, carbon monoxide, sulfur dioxide, temperature, humidity, air speed, and volume flow as required by applicable federal, state, and local regulations. (SDRD 1.2.6.4.1, Performance Criterion 5) All water used during operation and construction of the ESF shall be provided with chemical tracers as required by testing. (SDRD 1.2.6.7.5, Constraint 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(d) (continued)	Underground utilities (continued)			<p>All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7)</p> <p>The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)</p>
	Underground testing	The amount of water used in testing in the shaft should be limited to preclude interference with tests	Partially	<p>All water used during operation and construction of the ESF shall be provided with chemical tracers as required by testing. (SDRD 1.2.6.7.5, Constraint 1)</p> <p>The use of water in the development of underground openings shall be minimized to the extent practicable. (SDRD 1.2.6.6, Assumption 3)</p>
		Test procedures shall require the removal of excess water	N	
		Test procedures shall be developed to ensure that water entering the ESF is managed appropriately, including quantity, location, and water balance	Partially	<p>All water used during operation and construction of the ESF shall be provided with chemical tracers. (SDRD 1.2.6.2.2, Performance Criterion 7)</p> <p>The water systems and subsystems shall ensure that all of the water flows (point of discharge) are metered and that addition of tracers to the water systems and subsystems can be accomplished, as required, for the site characterization testing. (SDRD 1.2.6.2.2, Performance Criterion 8)</p>

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(e) (2)	First Shaft	The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that could impact the capability to reliably and adequately characterize the site	Partially	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.4 Constraint 3)
		An adequate distance between shafts shall be provided to limit potential mechanical and hydrological interference between the two shafts to the extent that it could impact the capability to reliably and adequately characterize the site	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918. (SDRD 1.2.6.5, Constraint 10)
	Second Shaft	The shaft shall be designed to provide stability and to reduce the potential for deleterious rock movement or fracturing that could impact the capability to reliably and adequately characterize the site	Partially	The shaft will be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.5 Constraint 3)
		An adequate distance between shafts shall be provided to limit potential mechanical and hydrological interference between the two shafts to the extent that it could impact the capability to reliably and adequately characterize the site	Partially	The centerline coordinate location of ES-1 (science shaft) shall be N766,255, E563,630 as defined by the Nevada Coordinate System. The centerline coordinate location of the ES-2 (second shaft), in the Nevada Coordinate System, shall be N766,337; E563,918)
	Underground excavation	The main test level of the ESF shall be designed to limit overall response to excavation, including rock fall, considering all planned drifts and future drifting that may be performed in the dedicated test area, consistent with obtaining adequate and reliable information from site characterization	Partially	Underground openings shall be designed and constructed to minimize impacts on underground site characterization. (SDRD 1.2.6.6 Performance Criterion 1) Underground openings within the Topopah Spring unit shall be designed to provide stability and to minimize the potential for deleterious rock movement or fracturing that may create a pathway for radionuclide migration. (SDRD 1.2.6.6 Performance Criterion 3)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(e) (2) (continued)	Underground excavations (continued)	The design of underground openings and their supports in the ESF shall utilize pillar and opening geometries that limit stress concentration, changes in rock mass permeability, and changes in rock mass deformability to levels consistent with acquiring adequate and reliable information from site characterization	Y	The design of underground openings and their supports shall utilize pillar and opening geometries that limit stress concentration to acceptable levels. (SDRD 1.2.6.6 Performance Criterion 5)
		The spacing between adjacent ESF drifts shall be a minimum of two drift diameters (using the maximum diameter of either opening and considering the closest proximity of any part of each opening) consistent with obtaining reliable and adequate information from site characterization	N	
	Underground testing	The ESF shall be designed to limit mechanical, hydro-logic, or geochemical interference between underground tests that may be associated with damage to the rock mass caused by excavation	Y	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydro-logical interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)
60.133(f)	Site	The main pad shall be constructed using excavation methods that will limit damage to the underlying rock mass, to the extent that it could affect the adequacy or reliability of information from site characterization. Methods shall be designed to facilitate investigation and monitoring of such effects during and after construction	Partially	The design and construction of the site (civil improvements) for the permanent ESF structures, systems, and components shall not significantly increase the preferential pathways for groundwater or radioactive waste migration to the accessible environment. (SDRD 1.2.6.1, Constraint 1)
	First Shaft	The shaft and shaft stations of the exploratory shaft shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of information from site characterization. The methods shall be designed to facilitate investigation and monitoring of such effects during and after construction	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.4 Constraint 2) Station development shall be performed by controlled blasting techniques. (SDRD 1.2.6.4.3 Performance Criterion 6)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.133(f) (continued)	Second shaft	The shaft and shaft stations of the exploratory shaft shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of information from site characterization. The methods shall be designed to facilitate investigation and monitoring of such effects during and after construction	Partially	Techniques used for shaft excavation shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.5 Constraint 2) Station development shall be performed by controlled blasting techniques. (SDRD 1.2.6.5.3 Performance Criterion 3)
	Underground excavation	The shaft breakouts and main test level of the ESF shall be constructed using controlled blasting methods, to limit overbreak and damage to the surrounding rock mass, which could affect the adequacy or reliability of site characterization. The methods shall be designed to provide for the requirements of specific site characterization tests, such as limitations on the extent of excavation-induced damage, or the type of ground support that may be installed. The methods shall be designed to facilitate monitoring and investigation of excavation effects during and after construction	Partially	Underground openings shall be designed and constructed to minimize impacts on underground site characterization. (SDRD 1.2.6.6 Performance Criterion 1) Excavation techniques shall control overbreak of rock and minimize disturbance to the integrity of the adjoining rock mass. (SDRD 1.2.6.6 Performance Criterion 23)
60.137	Site	The ESF site shall be designed to facilitate appropriate performance confirmation measurement and monitoring to obtain adequate and reliable information about the site. The performance confirmation program shall include measurement and monitoring of the performance of the ESF site to the extent that aspects of the site are part of the geologic setting that could contribute to the waste isolation performance of a repository	N	
	First shaft	The configuration of the shaft shall be adequate to support performance confirmation testing, and future performance confirmation testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing	Partially	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)
		The shafts of the ESF shall be designed to facilitate performance confirmation testing to obtain adequate and reliable information about the site, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F	Partially	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.137 (continued)	First shaft (continued)	The shafts of the ESF shall be designed so that base- line performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10) Shaft design and construction shall pro- vide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)
	Second shaft	The configuration of the shaft shall be adequate to support site performance confirmation testing, and future performance confirmation testing that may be reasonably expected for site characterization. This shall include an allowance to accommodate site specific conditions encountered in the shaft without adversely affecting testing that is planned or ongoing	Partially	Shaft design and construction shall pro- vide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5, Performance Criterion 12)
		The shafts of the ESF shall be designed to facilitate performance confirmation testing to obtain adequate and reliable information about the site, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F	Partially	Shaft design and construction shall pro- vide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5, Performance Criterion 12)
		The shafts of the ESF shall be designed so that base- line performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Constraint 10) Shaft design and construction shall pro- vide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5, Performance Criterion 12)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.137 (continued)	Underground excavation	The shaft breakouts and main test level of the ESF shall be designed to facilitate performance confirmation testing, during and after construction, as required for the geologic repository by 10 CFR 60, Subpart F	Partially	Testing instrumentation/hardware, cables, computer equipment, and data acquisition and monitoring systems, shall be designed to withstand the expected underground environment. (SDRD 1.2.6.8, Performance Criterion 10) Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)
		The shaft breakouts and main test level of the ESF shall be designed so that baseline performance confirmation data can be acquired, pertaining to parameters and natural processes that may be significantly altered by site characterization. In addition, the ESF shall be designed to facilitate monitoring of changes to the baseline condition of parameters that could affect performance of a geologic repository	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10) Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)
		The ESF underground excavation shall be of adequate size to support performance confirmation testing and future testing that may be reasonably expected for performance confirmation. This shall include an allowance to accommodate site specific conditions encountered in the dedicated test area	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10) Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)
		The design of the shaft breakouts and main test level of the ESF shall limit the extent of interference between characterization tests, performance confirmation tests and ESF construction and operation activities	Partially	Tests shall be designed and located within the facility to ensure that thermal, mechanical, chemical, and hydrological interactions will not endanger the structural stability of the ESF or adversely affect tests conducted in adjacent areas. (SDRD 1.2.6.8, Constraint 1)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.137 (continued)	Underground excavation (continued)	The design of the shaft breakouts and main test level shall have sufficient flexibility to: (1) relocate experiments as necessary to limit interference between tests, (2) incorporate additional performance confirmation tests, as needed, in the dedicated test area, and, (3) accommodate schedule changes as required		Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule, test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems:
			<u>Description</u>	<u>Uncertainty Allowance</u>
			Underground test area at the main test level	100 percent
			Systems	
			- Site	
			- Utilities	DETERMINED BY
			- Surface facilities	ANALYSES IN THE
			- First shaft	TITLE I DESIGN
			- Second shaft	
			- Underground excavations	
			- Underground utility systems	
			- Underground tests	

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 2 (CONTINUED)				
60.137 (continued)	Underground excavation (continued)			Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)
	Underground utilities	The design of underground utilities for the ESF shall be capable of supporting the performance confirmation testing	Partially	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10)
		The underground utilities for the ESF shall not preclude monitoring and investigation of in situ conditions, and shall be designed to accommodate site specific conditions, construction, and operation of the ESF	N	
	Underground testing	Performance confirmation testing shall be conducted in the ESF during and after construction, to meet the requirements which pertain to such testing in the geologic repository as stated in 10 CFR 60, Subpart F	Y	Performance confirmation testing shall be carried out to meet the requirements of 10 CFR 60, Subpart F. (SDRD 1.2.6.8, Performance Criterion 10)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 3				
60.15(b)	First shaft	Shaft design and construction shall provide access for site characterization activities to be performed at the planned waste emplacement horizon	Partially	Provide safe access between the ESF surface and the underground portion of the ESF to meet the needs of underground site characterization testing (at three levels) (SDRD 1.2.6.4 Functional Requirement 1)
		Selection of the horizon for the main test level shall be based on evaluation of stratigraphic information sources available during construction (e.g., from the MPBH activity, geologic mapping of the shafts, and a probe corehole drilled ahead of the shaft face in portions of the shaft) with respect to explicit horizon criteria	Partially	Drill cores from USW G-4 and other existing geologic data shall be used to design the ESF shafts and underground openings. (SDRD 1.2.6.0, Performance Criterion 6)
	Second shaft	Shaft design and construction shall provide access for site characterization activities to be performed at the planned waste emplacement horizon	Y	Provide safe access between the ESF surface and the candidate repository horizon to meet the needs of site characterization testing, emergency egress, ventilation intake and exhaust, major muck handling, and primary transport of heavy equipment. (SDRD 1.2.6.5, Functional Requirement 1)
		Selection of the horizon for the main test level shall be based on evaluation of stratigraphic information sources available during construction (e.g., from the MPBH activity, geologic mapping of the shafts, and a probe corehole drilled ahead of the shaft face in portions of the shaft) with respect to explicit horizon criteria	Partially	Drill cores from USW G-4 and other existing geologic data shall be used to design the ESF shafts and underground openings. (SDRD 1.2.6.0, Performance Criterion 6)
	Underground excavation	The ESF main test level shall be constructed at the planned repository horizon	Y	The proposed Main Test Level floor within the Topopah Spring Member at the first shaft will be defined as the 1020 level. (SDRD 1.2.6.6, Constraint 2)
	Underground testing	Underground testing shall be conducted in a facility constructed at the planned repository horizon	Y	The proposed Main Test Level floor within the Topopah Spring Member at the first shaft will be defined as the 1020 level. (SDRD 1.2.6.6, Constraint 2)

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 3 (CONTINUED)				
60.15(d) (2)	First Shaft	The number and depth of exploratory shafts shall be consistent with obtaining needed information for site characterization, while contributing to acquisition of representative data	Partially	The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule. (SDRD 1.2.6.4, Performance Criterion 9)
	Second Shaft	The number and depth of exploratory shafts shall be consistent with obtaining needed information for site characterization, while contributing to acquisition of representative data	Partially	The size and depth of the shaft shall be sufficient for in situ site characterization needs in terms of testing, personnel, materials, equipment, utilities, and schedule. (SDRD 1.2.6.5, Performance Criterion 10)
	Underground testing	The number and length of exploratory and monitoring boreholes drilled from the underground portion of the ESF shall be consistent with obtaining the needed information for site characterization	Partially	(SDRD Appendix B)
60.15(d) (3)	Underground testing	Exploratory, monitoring and testing boreholes shall be located where pillars are planned in the repository underground facility to the extent practicable. Implementation of this criterion within the designated test area of the ESF shall be consistent with obtaining the needed information for site characterization	Partially	(SDRD Appendices A and B)
60.74	Underground testing	The area set aside for future site characterization and performance confirmation testing, shall be representative of the overall designated test area with respect to rock characteristics that control acceptability of test locations.	N	
60.133(b)	First shaft	The shaft design shall have the flexibility needed to ensure that the location, orientation, geometry, and configuration of each test can be modified, as necessary to meet specific test location acceptance criteria for each test in the shaft, in response to actual site conditions encountered during construction	Partially	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.4, Performance Criterion 11)

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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 3 (CONTINUED)				
60.133(b) (continued)	Second shaft	The shaft design shall have the flexibility needed to ensure that the location, orientation, geometry, and configuration of each test can be modified, as necessary to meet specific test location acceptance criteria for each test in the shaft, in response to actual site conditions encountered during construction	Partially	Shaft design and construction shall provide for ESF design and construction testing, performance confirmation, and in situ site characterization testing to the extent necessary. (SDRD 1.2.6.5, Performance Criterion 12)
	Underground excavation	The design of the shaft breakouts, and the layout the main test level of the ESF, shall have the flexibility to ensure that the location, orientation, geometry, and configuration of each planned test can be modified, as necessary, to meet specific test location acceptance criteria, in response to actual site conditions encountered during construction	Partially	Underground openings shall be developed to meet the needs of in situ site characterization, including basic needs for the initially planned tests. Additionally an allowance for uncertainties for the test area needs at the main test level has been set at 100 percent; i.e., all major systems for ventilation, utilities, emergency egress, rock handling, personnel support, and others shall be analyzed to determine the need for and the impact associated with this uncertainty allowance. If it can be demonstrated that critical parts of the allowance would require excessive costs, schedule test disruption, or other program impacts to design, procurement, and/or construction later (after the basic test plan needs are completed), consideration shall be given to designing, procuring, and/or constructing these critical items as part of the initial facility. The uncertainty allowance for each of the major ESF systems shall be determined by an analysis of the following systems:

Table I-4. ESF criteria addressed in Title I Subsystem Design Requirements Document (SDRD)
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Part 60 Requirement	ESF Physical Element	Criteria Developed by DAA Group	Addressed in SDRD (Y/N)	Related SDRD Reference
NRC CONCERN 3 (CONTINUED)				
60.133(b) (continued)	Underground excavation (continued)			<p><u>Description</u> <u>Uncertainty Allowance</u></p> <p>Underground test area at the main test level 100 percent</p> <p>Systems</p> <ul style="list-style-type: none"> - Site - Utilities DETERMINED BY ANALYSES IN THE TITLE I DESIGN PHASE - Surface facilities - First shaft - Second shaft - Underground excavations - Underground utility systems - Underground tests <p>Specific allowances for each major system shall be identified and incorporated prior to the start of Title II design (detailed design). (SDRD 1.2.6.0 Performance Criterion 2)</p>
	Underground utilities	The design of the underground utilities shall provide the flexibility needed to support required flexibility in the design of the shafts, shaft breakouts, and the layout of the main test level of the ESF	Y	Provide for the distribution of utilities around the operations area of the Main Test Level in such a manner to allow for flexibility in the siting and construction of the final testing locations (SDRD 1.2.6.7 Functional Requirement 3)