Participant M&O
Database - PACSYMP
Prepared - 27-MAY-97:13:16:22

Yucca Mountain Site Characterization Project
Planning and Control System (PACS)
Participant Planning Sheet (PSA03)

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.3.11.1 M&O

P&S Account Title - SYSTEM. ACQUI. SURF.-BASED BORHLE GEOPHY LOG. DATA

PWBS Element Number - 1.2.3.11.1

PWBS Element Title - System. Acqui. Surf.-Based Borhle Geophy Log. Data

Baseline Start - 01-nov-1995
Baseline Finish - 30-sep-1997

					Fiscal Year Distribution							At
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	Complete
Annual Budget	427	117	1760	3658	0	0	0	0	0	0	0	0	10855

Statement of Work 2RV 07/03/97 2RV 07/03/97

The following quality affecting work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted requirements Traceability Network Matrix. QARD applies to this effort.

Plan, integrate, coordinate, and execute surface-based geophysical testing. Manage the procurement of surface-based geophysical services, including those for data collection, processing, and analysis. Analyze and interpret surface-based geophysical data. Develop quality assurance procedures for geophysical testing. Maintain equipment and software supporting surface-based geophysical testing. Conduct feasibility and prototype geophysical testing. Prepare reports, maps, and cross-sections to document surface-based geophysical testing and results.
- Scope includes geophysical logging of boreholes SD-11 and SD-13
Participant agrees to preform tasks and activities as described in subordinate FY97 Summary Accounts.

Summary Account	Title
TR3B1CO	FY1995 Carryover
TR3B1EB1	Borehole Geophysical Logging
TR3B1FA1	Sys Acq of Surf Base Geophys Log Data

TR3B1GA1 Surface Geophysical Data Collection.

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Larry R. Hayes	07/07/97	Dennis R. Williams	8/12/1997	R. D. HABBE	8-13-97
Preparer - signature		Technical Reviewer - signature		QA Reviewer - signature	
Larry R. Hayes				RD Habbe	

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.3.11.2 M&O

P&S Account Title - Surface-Based Geophysical Testing

PWBS Element Number - 1.2.3.11.2

PWBS Element Title - Surface-Based Geophysical Testing

Baseline Start - 01-oct-1995
Baseline Finish - 06-jul-1999

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
		Fiscal Year Distribution											
Annual Budget	1155	~~377~~ 274	~~508~~ 508	~~497~~ 497	0	0	0	0	0	0	0	0	~~2537~~ 2254

Statement of Work 2R4 07/03/97 2R4 07/03/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

OBJECTIVE:
Provide analysis of geophysical data that supports characterization of the Yucca Mountain site and vicinity. Support collection of geophysical data.

DESCRIPTION OF WORK:
- o Plan, integrate, coordinate, and execute surface-based geophysical testing. Manage the procurement of surface-based geophysical services, including those for data collection, processing, and analysis.
- o Analyze and interpret surface-based geophysical testing data.
- o Develop quality assurance procedures for geophysical testing.
- o Maintain equipment and software supporting surface-based geophysical testing.
- o Conduct feasibility and prototype geophysical testing.
- o Prepare reports, maps, and cross-sections to document surface-based geophysical testing and results.
- o Manage and process geophysical logging services; provide on-site supervision of logging; provide data validation and analysis, as required.

Participant agrees to perform tasks and activities as described in subordinate FY97 summary accounts.

In FY 1997, activities will include preparation of records packages and archiving of geophysical logging data, evaluation of neutron log data, and completion of a analysis of magnetic basement in the vicinity of Yucca Mountain. In addition, regional seismic reflection profiling data will be re-processed, if required, and cross-hole tomographic imaging initiated in the repository block.

All level 3 deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Interface with the Geophysical Logging company to establish the geophysical test plan for the new SD-type borehole at the crest of Yucca Mountain that was not included in the FY97 Surface-Based Geophysical Testing Program.

Summary Account	Title
TR3B2CO	FY1995 Carryover
TR3B2EB1	Borehole Geophysical Testing and Analysis
TR3B2EB2	Synthesis and Analysis of Geophysical Data
TR3B2FB2	Geophysical Data Analysis
TR3B2GA1	Geophysical Data Analysis
TR3B2GB2	Geophysics Support to LA & Confirmation Studies
TR3B2FB3	Geophysical Data Analysis

TR3B2 Surface-Based Geophysical Testing (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Laura R. Hayes	07/03/97	DENNIS R. WILLIAMS	8/12/1997	R. D. HABBG	8-13-97

Preparer - signature	Technical Reviewer - signature	QA Reviewer - signature
Laura R. Hayes		RD Hadley

Participant M&O
Database - PACSYMP
Prepared - 2-JUN-97:08:00:52

Yucca Mountain Site Characterization Project
Planning and Control System (PACS)
Participant Planning Sheet (PSA03)

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.3.11.3 M&O

P&S Account Title - Geophysics-ESF Suppt Subsurface Geophysical Testng

PWBS Element Number - 1.2.3.11.3

PWBS Element Title - Geophysics-ESF Suppt Subsurface Geophysical Testng

Baseline Start - 01-dec-1995
Baseline Finish - 30-sep-1998

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
			Fiscal Year Distribution										
Annual Budget	49	93	970	780	0	0	0	0	0	0	0	0	317~~142~~

Statement of Work 2RV 07/03/97.

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

OBJECTIVE:
Provide geophysical data collection within the Exploratory Studies Facility to support scientific studies, including hydrologic testing, thermal testing, and construction monitoring.

DESCRIPTION OF WORK:
- o Provide subsurface geophysical logging services and contract administration
- o Provide subsurface borehole depth measurement systems and deviation surveys
- o Provide subsurface borehole video inspection services
- o Provide subsurface geophysics instrumentation development and survey services

- Scope includes borehole geophysical logging in the E-W Drift.

Participant agrees to perform tasks and activities as described in subordinate FY97 summary accounts.

In FY 1997, subsurface geophysical testing will be carried out to support unsaturated zone testing, testing of the hydrologic properties of faults, and construction monitoring.

Work will be measured through performance based audits and surveillances.

07/02/97 DVW 8/12/1997

Summary Account	Title
TR3B3EB1	Geophysical Logging in the Exploratory Studies Fac
TR3B3FB3	ESF Geophysical Logging
TR3B3GA3	ESF Geophysical Logging

TR3B36A1 ESF Geophysical Logging and Data Collection

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Larry R. Hayes	07/03/97	Dennis R. Williams	8/12/1997	R.D. HABBE	8-13-97

Preparer - signature	Technical Reviewer - signature	QA Reviewer - signature
Larry R Hayes		RD Habbe

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.3.14.2 M&O

P&S Account Title - First ESF Thermal Test

PWBS Element Number - 1.2.3.14.2

PWBS Element Title - First ESF Thermal Test

Baseline Start - 01-oct-1995
Baseline Finish - 01-jul-2002

	Fiscal Year Distribution											
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
Annual Budget	3499	8333	~~443~~ 513	~~525~~ 525	~~218~~ 218	0	0	0	0	0	0	0	~~12275~~ 13088

Statement of Work

QRH 07/03/97

QRH 07/03/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

Statement of Work:
Perform the tasks and activities necessary to develop, plan, design, conduct, maintain, and analyze and document the results of the ESF thermal test comprising of the single heater test, ~~and~~ the drift scale test, and the second single heater test.

QRH 07/03/97

Participant agrees to perform tasks and activities as described in subordinate FY97 summary accounts. These activities include:

For the single heater test, perform the following in FY97:

* Conduct the single heater test through the heating phase and part of the cooling phase

* Perform analyses to forecast the results of the single heater test

* Analyze the results of the single heater test

* Prepare the Single Heater Test Progress Report

For the drift scale test, perform the following in FY97:

* Procure goods and services needed for the ESF thermal test

* Characterize the thermal test facility and prepare the report, "Characterization of Thermal Test Facility"

* Perform pre-test analyses of the drift scale test to finalize the test design and forecast results and document same into the report, "Drift Scale Test Design and Forecast Results"

* Install the heaters, the instruments and other equipment and components for the drift scale test and initiate the heating phase of the drift scale test

Participant agrees to perform tasks and activities as described in subordinate FY97 Summary Accounts.

All level 3 deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Summary Account	Title
TR3E2CO	FY1995 Carryover
TR3E2EA1	Procure and Install Instrumentation, Heaters, and
TR3E2EA3K	Procure the Heaters, Instruments and Other Equipme
TR3E2EB1	Prepare Test Design
TR3E2EB2	Prepare the Operating Plan for the First Explorato
TR3E2EB3	Characterize the Exploratory Studies Facility Ther

Inc. Dollars in Thousands (Esc.)

TR3E2 First ESF Thermal Test (continued)

Summary Account	Title
TR3E2EB4K	Install Heater & Instrmnt & Initiate Shakedown Tst
TR3E2EB5K	Characterize Driftscale Test Area
TR3E2FB1	Perform Pre-Test Analysis & Forecast Results
TR3E2FB13	Procure Instrmts & Serv for In-Situ Thermal Tests
TR3E2FB2	Conduct Single Heater Test Heating Phase
TR3E2FB23	Finalize Drift Scale Tst Dsgn, Perform Pretest An
TR3E2FB3	Conduct Single Heater Test Cooling Phase
TR3E2FB33	Characterize Drift Scale Tst Area & Prep Rpt
TR3E2FB4	Prepare Single Heater Test Status Report
TR3E2FB43	Install Drift Scale Test Heaters, Instrmts & Other
TR3E2GB1	Prepare Single Heater Test Final Report
TR3E2GB13	Prep Rpt on Drift Scale Test As Built & Early Resu
TR3E2GB2	Conduct Post-Test Characterization of Single Heate
TR3E2GB23	Prepare Drift Scale Test Progress Report
TR3E2GB3	Conduct Comp. Anal. of Single Heater Test Results
TR3E2GB33	Procure Materials and Services for Drift Scale Tst
TR3E2GB43	Analyze Drift Scale Test Results
TR3E2GB53	Conduct Drift Scale Test, Heating Phase

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
SP23RM3	Status Report on Single Heater Test Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone will be met upon the submission of the Single Heater Test Status Report describing the progression of the test since the heating phase started in August, 1996, documenting the as built test and the test results to date and the analyses and interpretations thereof. This report will document the results of an integrated analysis of the results of the heating phase and early cooling phase of the single heater test started on August 26, 1996. Measurements made by various sensors, instruments and methods will be presented at selected time steps and compared with corresponding predicted results. Synergistic interpretive analyses of the observed dat leading to inferences, if any, about heat-related processes such as heat transfer mechanism, dry-out and condesation zone formation will be reported. Interpretations in terms of coupled T-H-M-C processes will be developed and compared with a pre-tes predictions. Based on these analyses admustments to the test and modifications / refinements to the conceptual models may be recomended. Rock mass thermal expansion derived from thermal and mechanical measurements and rock mass deformation modulus at elevated temperature as directly measured will be reported. Results of ERT measurements and neutron logging will be analysed and presented. Results of the sensors and instruments in the hydrology holes and the chemistry holes will be analysed and presented. Effectiveness of ground penetrating radar as a means of measuring moisture content will be evaluated and reported on. Results of mapping by infrared thermal imaging will be analysed and presented. Results of measurements by ground penetrating radar will be evaluated and documented. An evaluation of the performance of the various measuring systems will be presented.	29-aug-1997

Inc. Dollars in Thousands (Esc.)

TR3E2 First ESF Thermal Test (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
	This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologicc Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted, if appropriate for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q	
SP3305M3	Drift Scale Test Design and Forecast Results Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone will be met upon submission of the Drift Scale Test Design and Forecast Results report which will update and finalise the driftscale test design in the FY96 Test Design report giving detailed description of the test configuration including number, types, dimensions and spatial locations of the heaters, the planned rate of application of heat, the predicted movement of the thermal pulse and development of the isotherms, the number, types and spatial locations of the measuring instruments, the frequency of measurements, the predicted observations and thee analyses supportring these predictions. Test results predicted based on several conceptual models other than the "design basis model" will be documented and the criteria for evaluating the various conceptual models via comprehensive synergistic analysis of the various predicted results and the observed results will be discussed. The desired duration of the heating and cooling periods and the reasons thereof will be reported. Criteria for deciding whether heating of adequate duration has been conducted will be listed. Conditions and observations that will necessiate adjustments to the test will be described. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall b consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Number when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Informatio Study and Evaluation System (GENISES) shall be submitted, if appropriate, for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	16-jul-1997

Inc. Dollars in Thousands (Esc.)

TR3E2 First ESF Thermal Test (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
SP3308M3	Rpt: Ambient Character of Drift Scale Test Area Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone will be met upon submission of the report, " Characterization o the Thermal Test Facility". The report will document the results of characterization of the thermal testing facilty before th start of the heating phase of the drift scale test. A similar FY96 report documented the results of pre-heating characterization of the single heater test area. The FY97 report together with the FY96 report will complete the characterization of the ESF thermal testing facility. To this end the FY97 report will include those results of characterizing the single heater test area that could not be included in the FY96 report. The report will contain the results af geologic mapping and infra-red thermal imaging. It will document the source of the video logs of the drift scale test holes. Results of geoengineering mapping will include RQD,Q and RMR as well as spacing, length, aperture, attitude and coating/infilling of fractures. Results of laboratory testing will include Young's modulus and Poisson ratio; thermal conductivity and thermal expansion; porosity, density, moisture content, moisture saturation and moisture imbibation potential; and quantitative mineralogic characteristics. As far as possible results will be presented in accordance with the reporting guidelines of applicable and appropriate ASTM/ ISRM standards, if any. Results of in situ bulk permeability measurements by pneumatic method will be presented in the report. Results of any other characterization of the thermal test that may be conducted will be included in the report. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted, if appropriate for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q	04-aug-1997
SP9200M3	Ltr Rpt: Recomm Ending Date of Single Htr Test Criteria - This milestone will be met upon submission of a letter to DOE/YMSCO stating that the heaters of the drift scale test	23-may-1997
SP9277M4	(YAR) Rpt: Single Heater Test Status Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the name deliverable in accordance with YAP5.1Q. The YAR will be completed and returned to the TPM within 30 calendar day of receipt of the deliverable associated with this YAR. This Milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by Technical Publications Management.	29-sep-1997

Inc. Dollars in Thousands (Esc.)

TR3E2 First ESF Thermal Test (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
	If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	
SP9319M4	(YAR) Rpt: DST Design & Forecast Rslts Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the name deliverable in accordance with YAP5.1Q. The YAR will be completed and returned to the TPM within 30 calendar day of receipt of the deliverable associated with this YAR. This Milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by Technical Publications Management. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	13-aug-1997
SP9513M4	(YAR) Rpt: Amb Charact of Drift Scale Test Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the name deliverable in accordance with YAP5.1Q. The YAR will be completed and returned to the TPM within 30 calendar day of receipt of the deliverable associated with this YAR. This Milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by Technical Publications Management. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	29-aug-1997

Approvals

Laura R. Hayes	07/03/97	Dennis R. Williams	8/12/1997	R.D. HABBS	8-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Laura R. Hayes				RD Habbs	
Preparer - signature		Technical Reviewer - signature		QA Reviewer - signature	

1.2.3.14.2. Due 8/12/1997

Deliverable Title: Second Single Heater Test Final Report
Deliverable ID: SP3E2DM3
Due Date: 01-Jun-00
Deliverable Acceptance Criteria: This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone will be met upon submission of the Second Single Heater Test Final Report. The report will document the as built test, the progression of the test with adjustments, if any, and a comprehensive interpretive analysis of the test results including an evaluation of the various measuring systems employed. This deliverable shall be prepared in accordance with OCRWM-approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include Record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted, if appropriate for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator.

This deliverable is complete when it is submitted to TPM. The deliverable will be submitted to YMSCO in accordance with YAP-5.1Q.

07/02/97

U.S. GEOLOGICAL SURVEY
SUMMARY OF ADDITIONAL FUNDING FOR ECRB CHANGE REQUEST

SA#		Summary Account Title	FY 1997	FY 1998	FY 1999	FY 2000	TOTAL
0G32211FB2	R	Stratigraphy	0	39	71	0	110
0G32212FB2	R	Complete Site Area Geologic Map	67	51	0	0	118
0G32212FB5	N	Geologic Mapping of the Enhanced Characterization Repository Block	0	833	0	0	833
0G32733FB1	N	Predictive Geotechnical Analysis for Enhanced Characterization	107	160	0	0	267
0G33123FBE	R	Air Permeability Testing	0	0	375	29	404
0G33123FBF	R	Hydrologic Characterization of Surface-Based Boreholes	20	90	150	0	260
0G33124FB8	R	Percolation Flux Across Repository Horizon	88	357	300	0	745
0G33124FBB	R	Air-Permeability & Hydrochemistry Testing ESF	0	0	221	0	221
0G33124FBD	R	Moisture Monitoring in the ESF	0	185	150	0	335
0G33124GBA	N	Infiltration of Construction Water in the ESF	0	101	0	0	101
0G33126GB1	N	Gas Phase Movement in the Unsaturated Zone	0	0	279	0	279
0G33127GB2	R	Isotopic & Hydrochemical Studies of UZ Water & Gas	0	0	255	0	255
0G33131FBF	R	WT Eh and Ph Measurements	0	100	175	0	275
0G33131FBG	R	Perched-Water Testing and SZ Hydraulic Testing	0	0	334	0	334
0G36221FB3	R	Syn. Dist. & Anal Geochron. Age Dets Potent Repos. Blk	0	441	520	0	961
		TOTAL	282	2357	2830	29	5498

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-Apr-97 to 30-Apr-97
	PACS Participant Work Station (PPWS)	Page - 1
Prepared - 05/30/97:11:10:50	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.2.2.1.1 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Vert. and Lat. Dist. of Strat. Units in Site Area	BASELINE Finish Date	- 07/02/98
WBS No.	- 1.2.3.2.2.1.1		
WBS Title	- Vert. and Lat. Dist. of Strat. Units in Site Area	Element ID	- QG32211

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
				Fiscal Year Distribution									
Annual Budget	385	105	398	718	0	0	0	0	0	0	0	0	600.590

Statement of Work: RWC 7/2/97

RWC 7/2/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

OBJECTIVE:
Develop an adequate understanding of the three-dimensional stratigraphy in the vicinity of Yucca Mountain to support development of a 3-D Integrated Site Model, process modeling, design, performance assessment, and preparation of a license application.

DESCRIPTION OF WORK:
o Using geological and geophysical methods, determine the three-dimensional stratigraphic framework for Yucca Mountain.
o Measure and correlate rock properties with in situ properties as determined by geophysical methods.
o Identify mineral variations that produce observed changes in magnetic susceptibility and remanent magnetization. Measure total intensity and magnetic susceptibility variation with depth in borehole and correlate with available data. Develop empirical relationships between depositional breaks and variations in magnetic properties.
o Collect samples from drill cores. Perform detailed petrographic studies of selected core intervals. Develop database of rock samples from boreholes.
o Integrate lithologic data for input to site and regional models.

For FY 1997, re-examine lithologic logs for existing boreholes to reconcile the stratigraphy with the new stratigraphic nomenclature, integrate revised lithologic logs into the effort to develop a 3-D geologic framework for Yucca Mountain, compile revised lithologic logs in digital format, and prepare written documentation of the revised lithologic logs. Complete re-evaluation of key stratigraphic contacts to support development of 3-D Geologic Framework model, complete and submit borehole fracture database, and verify Q status of pre-1991 digital borehole geophysical logs.

RWC - insert A attached 7/2/97

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Summary Account	Title
OG32211D96	Compilation and Synthesis of Existing Stratigraphi
OG32211FB1	Review & Revision of Lithostratigraphy Borehole Db
OG32211GA1	Stratigraphic Support to LA & Confirmation Studies
OG32211H96	Geophysical Investigations
OG32211K96	Analysis of Pre 1985 Geophysical Logs

OG32211F02 Stratigraphy

RWC 7/2/97

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-Apr-97 to 30-Apr-97
	PACS Participant Work Station (PPWS)	Page - 2
Prepared - 05/30/97:11:10:50	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.1 OG -Vert. and Lat. Dist. of Strat. Units in Site Area

Approvals

Robert W. Craig	7/2/97	Dennis R. Williams	8/13/1997	R.D. HABBE	8-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig				RD Habbe	
Preparer - Signature		Technical Reviewer - Signature		QA Reviewer - Signature	Date

Rec'd 7/2/97

WBS 1.2.3.2.2.1.1 .
Vert. and Lat. Dist. of Strat. Units in Site Area
ATTACHMENT A

For FY 1998 and FY1999, the added scope to this summary account will provide input to the stratigraphic reports for the SD-11 borehole planned to be drilled in FY 98 and the SD-13 borehole planned to be drilled in FY 99. Stratigraphy will be developed using core, cuttings, borehole geophysical logs, television camera logs, and other materials as appropriate and available. The stratigraphic data will support UZ and SZ hydrologic testings and analysis/interpretation of test results, and be input into the 3-D geologic framework model, which in turn provides the geologic basis for the hydrologic flow and radionuclide transport models. This work will be done in conjunction with SA TR32211FB1, with the geologists in both accounts providing input and review to each other.

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System PACS Participant Work Station (PPWS) Participant Planning Sheet (PSA03)	01-Apr-97 to 30-Apr-97 Page - 1
Prepared - 05/30/97:11:10:50		Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.2.2.1.2 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Structural Features within the Site Area	BASELINE Finish Date	- 09/30/98
WBS No.	- 1.2.3.2.2.1.2		
WBS Title	- Structural Features within the Site Area	Element ID	- OG32212

		Fiscal Year Distribution										
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
Annual Budget	2970	~~2397~~ 2464	~~884~~	0	0	0	0	0	0	0	0	0	6318 ~~5367~~

Statement of Work: Rec 7/2/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix. Rec 7/2/97

OBJECTIVE:
Develop an adequate understanding of the three-dimensional geologic structure in the vicinity of Yucca Mountain to support development of a 3-D Integrated Site Model, process modeling, design, performance assessment, and preparation of a license application.

DESCRIPTION OF WORK:
- o Carry out structural geologic mapping of Yucca Mountain and vicinity.
- o Measure and analyze fracture characteristics (density, orientations, apertures, roughness, trace length, spatial distribution, degree of connectivity, fracture-filling minerals) for surface exposures, at depth in boreholes, and in the Exploratory Studies Facility (ESF).
- o Perform geologic mapping of the ESF.
- o Carry out prototype photogrammetric mapping in the ESF.
- o Integrate structural geologic results with efforts to develop site and regional geologic and process models.

For FY 1997, prepare a site area geologic map, support development of the 3-D Integrated Site Model, update the fracture synthesis report and carry out an analysis of fractures as they relate to Cl-36 findings, and carry out geologic mapping of the ESF. Insert Attachment A Rec 7/2/97

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Summary Account	Title
OG32212FB2	Complete Site Area Geologic Map
OG32212FB3	Fracture Studies
OG32212FB4	Geologic Mapping of the Exploratory Studies Facil
OG32212GA3	Structural Support to LA & Confirmation Studies
OG32212GA4	ESF Geologic Data Analysis
OG32212M96	Geologic Map of the Central Block of the Proposed
OG32212J96	Exploratory Studies Facility Mapping (USGS)
OG32212FB5	Geologic Mapping of the Enhanced Characterization Repository Block

Rec 7/2/97

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG22M3	Geol. Map of the Yucca Mountain Site Area Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone will be satisfied by completion of a geologic map of the Yucca Mountain Site Area. The map will be prepared at a 1:24,000-scale and will cover the area from Crater Flat east to Fortymile Wash and from the southern extent of the Claim Canyon Caldera south to the Busted Butte area. The map will include faults, contacts of geologic formations and zones (as appropriate), lithologic descriptions, cross sections, and a map unit correlation chart. The map will describe the nature of structural domains and provide information of the dominant dip domains within each structural block. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	29-Aug-97
SPG22M5	(YAR) Geol. Map of the Yucca Mountain Site Area Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	29-Sep-97
SPG322M5	(YAR) Rpt: Complete Fracture Evaluation Report Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within	29-May-97

Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG322M5	30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	
SPG32M3	Complete Fracture Evaluation Report Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This deliverable will be satisfied by completion of a report incorporating all available Q'd fracture data for each of the lithostratigraphic units developed for the site area UZ hydrologic flow model within the major structural blocks defined by the model. Report will include data from previous and new surface studies, ESF fracture studies, and available Q'd borehole data. The report will include an assessment (comparison) of Q'd and non-Q'd borehole (borehole TV logs and core data) data, as appropriate. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	30-Apr-97
SPG42AM3	Rpt Geo North/South Main Drft Sta 28+00 to55+00 Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60	28-Feb-97

Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG42AM3	days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone report will consist of a compilation and summary of mapping data collected in the Exploratory Studies Facility (ESF) from Station 28+00 through 55+00. It will enhance the map and data deliverable for the same interval presented earlier as milestone 3GGF603M. The report will integrate all mapping and other data, including, as appropriate, data from the north ramp report, to present a complete description of the geology of the north/south main drift of the ESF. Maps included with the report will cover from station 28+00 to 55+00, and be presented at a scale of 1:125. These full-periphery geotechnical maps will show mapped geologic units and subunits, fractures, faults, and other important structural features (as appropriate), the location of all samples collected by the mapping group (or collected by PIs and/or the ESF Technical Coordination Office), and as-constructed installed ground support and type. The deliverable will supply fracture analysis for the north/south main drift in the form of tabulated data sets, stereo plots, and statistical treatment of fracture information (by stratigraphic unit, or some selected interval along the course of tunnel excavation). A cross section comparing the predicted geology of the north/south main drift and as-determined structural and stratigraphic interpretations will be presented. Predicted and actual stratigraphic, structural and other key features will be discussed in the report. Important sampling and testing activities will be identified and discussed, as appropriate. A general discussion of the stratigraphy and structure will be provided that will include characterization of predicted locations of known or suspected fault features such as the Sundance and Ghost Dance faults. The report will also include a description of rock characteristics associated with features that do not lend themselves well to graphical presentations contained in the report such as fault gouge and breccia. Results of the detailed line survey and appropriate graphical and tabular presentation of data will be included in the report. A summary of photographic work conducted in support of the mapping exercise will be provided as part of the report. The stereophotography will be identified within the report (photo numbers, current archive location) for future reference. The report will briefly describe any unusual features observed in the mapping, detailed line survey, photogrammetry, or sampling exercises. Results of the RQD and Q & RMR analyses will also be provided and integrated into map or other graphical presentations of related data. Simple statistical treatment or qualitative assessment of the results of the subject survey will be provided. Alcove maps (for constructed portions of Alcove 5, the thermal test facility, and Alcove 6, the north Ghost Dance Alcove), a summary of detailed line survey data, stereo photographic information, tabulations and assessment of structural data from alcove	

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG42AM3	mapping investigations, and statistical treatment of alcove fracture data will be included in the report. Alcove borehole information will be incorporated for enhanced assessment of the geometry of stratigraphic units and structural features, as appropriate. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Optional: Stratigraphy used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	
SPG42AM5	(YAR) Rpt Geo N/South Main Drft Sta 28+00 to 55+00 Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	28-Mar-97
SPG42BM3	Ltr Rpt: Geo S.R. Sta 55+00 to STA 63+47 Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR).	28-Feb-97

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG42BM3	This milestone data submittal will consist of a compilation of maps, graphical data treatments, and data collected in the Exploratory Studies Facility (ESF) from Station 55+00 through Station 63+47. Maps included will be presented at a scale of 1:125. These full-periphery geotechnical maps will show mapped geologic units and subunits, fractures, faults, and other important structural features (as appropriate), the location of all samples collected by the mapping group (or collected by PIs and/or the ESF Technical Coordination Office), and as-constructed installed ground support and type. The deliverable will supply first-order graphical fracture analysis in the form of tabulated data sets, stereo plots, and statistical treatment of fracture information (by stratigraphic unit, or some selected interval along the course of tunnel excavation) as necessary for illustrative purposes. A cross section comparing the predicted geology of the south ramp through Station 63+47 and as-determined structural and stratigraphic interpretations will be presented. Results of the detailed line survey and appropriate graphical and tabular presentation of data will be included in the data submittal. Results of the RQD and Q&RMR analyses will also be provided and integrated into map or other graphical presentations of related data. Simple statistical treatment or qualitative assessment of the results of the subject survey will be provided. Alcove maps (for additional constructed portions of Alcove 5, the thermal test facility, and Alcove 6, the north Ghost Dance Alcove), line survey data, stereophotography, tabulations and assessment of structural data from alcove mapping investigations, and statistical treatment of alcove fracture data will be included in the report. Alcove borehole information will be incorporated for enhanced assessment of the geometry of stratigraphic units and structural features, as appropriate. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG428M3		
SPG42BM5	(YAR) Ltr Rpt: Geo S.R. Sta 55+00 to Sta 63+47 Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	28-Mar-97
SPG42CM3	Ltr Rpt: Geo of S.Ramp, Sta 55+00 to S. Portal Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This milestone report will consist of a compilation and summary of mapping data collected in the Exploratory Studies Facility (ESF) from Station 55+00 through the end of the south ramp. The report will integrate all mapping and other data, including, as appropriate, data from the north/south main drift report, to present a complete description of the geology of the south ramp of the ESF. Maps included with the report will cover from station 55+00 to the south portal, and be presented at a scale of 1:125. These full periphery maps will show mapped geologic units and subunits, fractures, faults, and other important structural features (as appropriate), the location of all samples collected by the mapping group (or collected by PIs and/or the ESF Technical Coordination Office), and as-constructed installed ground support and type. The deliverable will supply fracture analysis for the south ramp in the form of tabulated data sets, stereo plots, and statistical treatment of fracture information (by stratigraphic unit, or some selected interval along the course of tunnel excavation). A cross section comparing the predicted geology of the south ramp and as-determined structural and stratigraphic interpretations will be presented. Predicted and actual stratigraphic, structural and other key features will be discussed in the report.	30-Aug-97

Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG42CM3	Important sampling and testing activities will be identified and discussed, as appropriate. Results of detailed line survey and appropriate graphical and tabular presentation of data will be included in the report. A summary of photographic work conducted in support of the mapping exercise will be provided as part of the report. The stereophotography will be identified within the report (photo numbers, current archive location) for future reference. The report will briefly describe any unusual features observed in the mapping, detailed line survey, photogrammetry, or sampling exercises. Results of the RQD and Q & RMR analyses will also be provided. Alcove maps (for additional constructed portions of Alcove 5, the thermal test facility, and Alcove 6, the north Ghost Dance Alcove), a summary of the detailed line survey data, stereo photographic information, tabulations and assessment of structural data from alcove mapping investigations, and statistical treatment of alcove fracture data will be included in the report. Alcove borehole information will be incorporated for enhanced assessment of the geometry of stratigraphic units and structural features, as appropriate. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q.	
SPG42CM5	(YAR) Ltr Rpt: Geo S. Ramp, Sta 55+00 to S. Portal Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received	29-Sep-97

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-Apr-97 to 30-Apr-97
	PACS Participant Work Station (PPWS)	Page - 9
Prepared - 05/30/97:11:10:50	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No. - 1.2.3.2.2.1.2 OG -Structural Features within the Site Area

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPG42CM5	by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days. RWC 7/2/97	
SPG42M3	Report on the Geology of the Cross Block Drift - insert Attachment B- Criteria	31-aug-98

Approvals

Robert W. Craig 7/2/97	Dennis R. Williams 8/12/1997	R. D. HABBE 3-13-97
Preparer - print name / Date	Technical Reviewer - print name / Date	QA Reviewer - print name / Date
Robert W. Craig		R D Habbe
Preparer - Signature	Technical Reviewer - Signature	QA Reviewer - Signature / Date

Rec
7/2/97

WBS 1.2.3.2.2.1.2
Structural Features Within the Site Area
ATTACHMENT A

For FY 1997 and FY1998, prepare a predictive cross-section and prepare a memorandum to the USGS TPO on the 1) nature of fracturing; 2) a prediction of footwall/hanging wall deformation, and; 3) nature of faulting to be in the geology to be encountered along the alignment of the ECRB drift. The model for the nature of footwall deformation along the Solitario Canyon Fault to be developed will concentrate on the area to be encountered by the ECRB drift and will help constrain future repository design and construction efforts. The cross-section will incorporate existing mapping with minor field checking and confirmation of the Central Block (1:6,000-scale) map area.

For FY1998, conduct full-periphery geologic mapping and detailed line surveys in the Enhanced Repository Block Characterization from station 0+00 to 23+00. Data from the mapping will be fed in a non-QA form relatively quickly to the Project for assessment of encountered conditions. Provide geotechnical data from as-built excavations for verification of preconstruction predictions. Conduct mapping in associated alcoves and niches associated with the ECRB. Prepare a report addressing the major topics of geologic setting, geologic features of engineering and construction significance, and encountered ground conditions, and assessing the predictive capabilities for geologic and geotechnical parameters.

RLC 7/2/97

WBS 1.2.3.2.2.1.2 Structural Features Within the Site Area

ATTACHMENT B

SPG42GM3 Report on the Geology of the Cross Block Drift 30-sep-98

This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR).

This milestone report will consist of a compilation and summary of mapping data collected in the cross block drift.. It will include data delivery for the same interval into the GENISES data base.

The report will integrate all mapping and other data, including, as appropriate, maps at a scale of 1:125, geologic units and subunits, fractures, faults, and other important structural features (as appropriate), the location of all samples collected for mineralogical or geochemical analysis and as-constructed installed ground support and type.

The deliverable will supply fracture analysis for the cross block drift in the form of tabulated data sets, stereo plots, and statistical treatment of fracture information (by stratigraphic unit, or some selected interval along the course of tunnel excavation).

A cross section comparing the predicted geology of the cross block drift and as-determined structural and stratigraphic interpretations will be presented. Predicted and actual stratigraphic, structural and other key features will be discussed in the report. Important sampling and testing activities will be identified and discussed, as appropriate. A general discussion of the stratigraphy and structure will be provided that will include characterization of predicted locations of known or suspected fault features. The report will also include a description of rock characteristics associated with features that do not lend themselves well to graphical presentations contained in the report such as fault gouge and breccia.

Results of the detailed line survey and appropriate graphical and tabular presentation of data will be included in the report. The report will briefly describe any unusual features observed in the mapping, detailed line survey, or sampling exercises. Results of the RQD and Q & RMR analyses will also be provided and integrated into map or other graphical presentations of related data. Simple statistical treatment or qualitative assessment of the results of the subject survey will be provided.

Alcove maps (for constructed portions of the various test alcoves and niches), a summary of detailed line survey data, tabulations and assessment of structural data from alcove mapping investigations, and statistical treatment of alcove fracture data will be included in the report. Alcove borehole information will be incorporated for enhanced assessment of the geometry of stratigraphic units and structural features, as appropriate.

This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Optional: Stratigraphy used shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. Within the report's Reference Section, references to data used in the report shall include record Accession Numbers or Data Tracking Numbers when available. Technical data contained within the deliverable and not already incorporated in the Geographic Nodal Information Study and Evaluation System (GENISES) shall be submitted for incorporation into the GENISES in accordance with YAP-SIII.3Q. Verification of technical data submittal compliance shall be demonstrated by including as part of the deliverable: 1) a copy of the Technical Data Information Form generated identifying the data in the Automated Technical Data Tracking system, and 2) a copy of the transmittal letter attached to the technical data transmittal to the GENISES Administrator. This deliverable shall be processed in accordance with YAP-5.1Q. This deliverable is complete when it is logged into the TDIN database.

YMP-223-R0
09/18/95

Participant - USGS
Database - PROPOSED
Prepared - _____

Yucca Mountain Site Characterization Project
Planning and Control System (PACS)
Participant Planning Sheet (PSA04)

Contract - _____

Page 1 of _____

Inc. Dollars in Thousands

P&S Account - 1.2.3.2.7.3.3 OG (New Account)

P&S Account Title - In-Situ Mechanical Properties

PWBS Element No. - 1.2.3.2.7.3.3

PWBS Element Title - In-Situ Mechanial Properties

BASELINE Start 9-Sep-1997
BASELINE Finish 14-Nov-1997

QA - _____

FISCAL YEAR DISTRIBUTION

Annual Budget

Prior	FY 97	FY 98	FY 99	FY 100	FY 101	FY 102	FY 103	FY 104	FY 105	FY 106	Future	At Complete
	107	160										267

STATEMENT OF WORK

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current 0CRWM-accepted Requirements Traceability Network Matrix.

OBJECTIVE:

Obtain in-situ measurements of the mechanical properties of rock mass

DESCRIPTION OF WORK:

Develop a predictive geotechnical memorandum to support three goals: 1) Exercise predictive capabilities for stratigraphy, rock properties and expected ground conditions; 2) provide geotechnical results from the enhanced characterization program to support the viability assessment; 3) provide geotechnical data to support design in advance of construction enhanced characterization.

Summary Account	Title
0G32733FB1	Predictive Geotechnical Analysis for Enhanced Characterization

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

CONCURRENCE

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Larry R. Hayes	7/11/97	[illegible]	8/12/1997	R.D. HABBE	8-13-97
Preparer - signature		Technical Reviewer - signature		QA Reviewer - signature	
Larry R. Hayes		[illegible]		R.D. Habbe	

RLC 7/2/97

P&S Account No.:	1.2.3.2.7.3.3 0G **(NEW ACCOUNT)**
P&S Account Title:	In-Situ Mechanical Properties
WBS No.	1.2.3.2.7.3.3
WBS Title:	In-Situ Mechanical Properties
Baseline Start Date:	02 September 1997
Baseline Finish Date:	14 November 1997
PSS ID#:	

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current 0CRWM-accepted Requirements Traceability Network Matrix.

OBJECTIVE:
Obtain in-situ measurements of the mechanical properties of rock mass

DESCRIPTION OF WORK:
Develop a predictive geotechnical memorandum to support three goals: 1) Exercise predictive capabilities for stratigraphy, rock properties and expected ground conditions; 2) provide geotechnical results from the enhanced characterization program to support the viability assessment; 3) provide geotechnical data to support design in advance of construction enhanced characterization.

Budget for FY 1997 - $107K
Budget for FY 1998 - $160K
Total Budget - $267K

Summary Account	Title
0G32733FB1	Predictive Geotechnical Analysis for Enhanced Characterization

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System PACS Participant Work Station (PPWS)	01-May-97 to 31-May-97 Page - 1
Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.3.1.2.3 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Perc. in the Unsaturated Zone - Surf. Based Study	BASELINE Finish Date	- 01/29/99
WBS No.	- 1.2.3.3.1.2.3		
WBS Title	- Perc. in the Unsaturated Zone - Surf. Based Study	Element ID	- OG33123

		Fiscal Year Distribution										
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
Annual Budget	1285	125 145	670 760	95 620	829	0	0	0	0	0	0	0	2775 3439

Statement of Work: Rec 7/2/97

Rec 7/2/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Conduct testing permeability, moisture-retention curves and relative permeability of small and large cores to determine saturated fluid. Conduct testing of new methodology to determine water and matric potential. Conduct testing of submersible pressure plate, psychrometer-microwave and gas driven methods to determine moisture-retention relations. Conduct testing of submersible pressure plate, one-step outflow; steady-state centrifuge; steady-state evaporation; calculation modeling; and combined moisture-retention and relative-permeability methods to determine relative permeability. Develop a matrix-property sampling program for surface based boreholes. Determine physical and matrix-hydrologic properties by laboratory analysis of rock samples. Conduct borehole geophysical surveys, geohydrologic contacts, and fracture frequency, spacing, and orientation by detailed analysis of rock samples. Conduct statistical analysis to determine spatial variability of hydrologic parameters. Develop and test borehole instrumentation systems. Conduct stemming, in situ instrumentation, and monitoring of boreholes. Develop and test VSP methodology. Conduct vertical seismic profiling of boreholes. Develop and test IDAS system. Record, process, archive data. Conduct in situ pneumatic tests. Conduct field tracer tests to determine bulk gaseous-dispersion coefficients for ambient conditions. Determine physical and matrix hydrologic properties by laboratory analysis of rock samples. Conduct boreholes geophysical surveys. Determine lithology, geohydrologic contacts, and fracture frequency, spacing, and orientation by detailed analysis of geologic samples. Conduct water-injection tests. Conduct stemming and in situ instrumentation and monitoring. Record, process, transmit and archive data. Conduct hydraulic tests in SD 7; install temporary instruments to obtain pneumatic data from SD 7; compile and report on results.

Activities in FY 1997 include:

Measurements of matrix-hydrologic properties will be performed on core samples from test holes drilled in ESF alcoves, particularly the alcoves excavated into the Ghost Dance Fault from the Main Drift. Matrix-properties data will be used to assist in the placement of boreholes and instrumentation for the ESF Radial Boreholes and Major Faults tests. The data also will be used to help interpret the results of hydrochemical and air-permeability testing. Limited flow-properties determinations will be performed on existing rock-core samples. Emphasis will be on measuring unsaturated hydraulic conductivities using the ultra-centrifuge and water-retention relations for samples from the vitric and zeolitic facies of nonwelded tuff hydrogeologic units. These core samples will come from boreholes SD-9, SD-12, and SD-7 as well as other selected boreholes, as appropriate. Monitoring pneumatic pressure, temperature, and water potential will continue in selected instrumented boreholes. Instrumentation records and raw data collected will be submitted to the Records Processing Center.

Activities for FY 1997 and FY 1998 include:

Borehole monitoring data, specifically, in situ pneumatic pressure, temperature, and water potential from boreholes monitored during this period will be reduced and analyzed. Analyses of the data will include evaluations of barometric pressure damping and

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.3 OG -Perc. in the Unsaturated Zone - Surf. Based Study

Statement of Work (cont.):

logging with depth, temperature gradients and stability, and water potential equilibration behavior with respect to the stratigraphic units and depths at which instrument stations are located. Conduct analyses to provide a prediction of hydrologic conditions and hydrogeologic properties for surface-based boreholes SD-11 and SD-13, and conduct sample testing and analyses to provide the characterization of hydrologic conditions and hydrogeologic conditions and properties for boreholes SD-11 and SD-13 for the evaluation of hydrologic predictions.

DUE 7/2/97

Activities for F Y 1999:
Conduct air permeability testing in boreholes USW SD-13 and USW SD-11 using existing surface-based air permeability equipment consisting of borehole packers, packer handling equipment, and associated borehole instrumention and data acquisition systems.

DUE 7/2/97

Summary Account	Title
OG33123C96	Vertical Seismic Profiling: Borehole UE-25UZ#16
OG33123D96	Unsaturated Zone Borehole Instrumentation and Mon
OG33123FB4	Integrated Analysis & Interpretation
OG33123FB5	Matrix Properties of Hydrologic Units
OG33123FBA	Unsaturated Zone Borehole Instrumentation & Monito
OG33123FBB	Unsaturated Zone Borehole Instrumentation & Monito
OG33123FBC	Integrated Analysis & Interpretation
OG33123FBD	Matrix Properties of Hydrologic Units
OG33123G96	Integrated Analysis and Interpretation
OG33123GB1	Unsaturated Zone Borehole Instrumentation & Monit.
OG33123GB2	Integrated Analysis & Interpretation
OG33123H96	Matrix Properties of Hydrologic Units
OG33123K96	Temporary Instrumentation of SD-7
OG33123FBE	Air Permeability Testing
OG33123FBF	Hydrologic Characterization of Surface-Based Boreholes

DUE 1/2/97

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPH223M3	Main Drift Hydrology Report Criteria - This level 3 milestone will consist of an interpretive report describing the hydrogeology along and adjacent to the Main Drift and South Ramp of the Exploratory Studies Facility. The report will provide a synthesis and analysis gathered from pneumatic monitoring, temperature monitoring, water-potential monitoring, air permeability testing, matrix hydrologic-properties testing, geologic and geophysical logging, hydrochemical sampling, and testing of perched-water occurrences in surface-based boreholes near the Main Drift. This report contributes directly to the assessment of possible preferential pathways for fluid (liquid and gas) flow into and through the unsaturated zone at Yucca Mountain. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature cited in the deliverable shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. The report shall note data used and shall include record Accession Numbers or Data Tracking Numbers when available. This deliverable shall be processed in accordance with YAP-5.1Q.	14-Mar-97
SPH223M5		

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.3 OG -Perc. in the Unsaturated Zone - Surf. Based Study

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SPH223M5	(YAR) Main Drift Hydrogeology Report Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	11-Apr-97

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig	7/2/97	Dennis R. Williams	8/8/1997	R. D. HABBE	8-13-97
Preparer - Signature		Technical Reviewer - Signature		QA Reviewer - Signature	Date
Robert W. Craig				RD Habbe	

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
	PACS Participant Work Station (PPWS)	Page - 1
Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.3.1.2.4 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Percolation in the Unsaturated Zone - ESF Study	BASELINE Finish Date	- 09/30/99
WBS No.	- 1.2.3.3.1.2.4		
WBS Title	- Percolation in the Unsaturated Zone - ESF Study	Element ID	- OG33124

					Fiscal Year Distribution							At
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	Complete
Annual Budget	688	1048 1136	1329 1972	150 821	0	0	0	0	0	0	0	0	4617 3215

Statement of Work:

RLC 7/2/97

RLC 7/2/97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Map individual fractures, joint sets and fracture networks in areas of sample collection. Conduct radial flow studies for approximately 12 samples in each of four hydrogeologic units containing fractures perpendicular to the core axis. Conduct axial flow studies for approximately the same number as above containing fractures parallel to the axis of the core. Conduct laboratory determination of the hydraulic properties of the rock matrix. Conduct stress-permeability tests (single- and two-phase) to determine hydraulic properties under a range of applied stresses. Conduct tracer-injection tests to obtain breakthrough curves and effective porosities. Conduct flow-channelization tests to collect fracture plane geometry data. Conduct computer modeling of fluid flow in discrete fractures. Develop formal procedures for radial and axial intact-fracture sampling to be used in the ESF hydrologic testing program. Identify appropriate equipment for intact fracture sampling. Collect intact fracture samples for the laboratory analysis of intact fractures prototype test. Determine technical procedures for preparing fracture samples for the test apparatus including: 1) core sizing, 2) rock bolt and clamp removal, and 3) drilling techniques. Determine specific instruments which will measure the desired variables. Design and implement a local data acquisition system (DAS) which will record the collected data from the instrumented core, flow metering system, and the test apparatus. Determine the feasibility of conducting stress-permeability tests on intact fracture cores for single- and two-phase studies. Determine the feasibility of conducting tracer injection/dispersivity tests on intact fracture cores. Determine the feasibility of conducting fracture-flow channelization/tortuosity tests to determine fracture plane geometry.

Conduct laboratory experiments to evaluate the applicability of psychrometers, tensiometers, conductivity probes and time-domain reflectometry for characterizing the moisture state of fractured tuff, including moisture-front detection, and redistribution and steady-state monitoring. Evaluate conductivity probes as a method for detecting tracer movement in fractures. Design and construct a sprinkler infiltrometer capable of delivering water to the block surface at a wide range of flow rates, with the development of the software necessary for proper operation of the infiltrometer. Establish a workable data acquisition system, for data retrieval, storage and reduction. Evaluate optimal borehole orientation and spacing, and time requirements for various phases of the test. Excavate a single block of Topopah Springs welded unit from the repository horizon. Conduct pre-and post-excavation single-hole and cross-hole packer-injection tests across discrete fractures or fracture zones to determine effects of excavation. Conduct laboratory determination of the hydraulic properties of cores taken from the matrix of the excavated block. Saturate the block to the point of steady state flow to estimate saturated bulk rock conductivity and percolation rate. Apply successively lower percolation rates, with concurrent measurement of average matric potential and hydraulic gradients, for the purpose of calculating a composite conductivity-matric potential relationship for the block. Conduct tracer test to establish a relationship between fluid flux and effective porosity. Characterize the rock-matrix lithology and hydrologic properties at each of the four sites. Characterize fracture network through fracture mapping in drifts associated with the bulk-permeability tests. Perform single-hole packer air-injection tests, cross-hole tests and tracer tests at four sites within the ESF to assess fluid transport properties. Assess applicability of discrete fracture network and/or stochastic continuum models to predict bulk permeability of fractured rock. Evaluate equipment, conceptual design and interpretation techniques prior to implementation in the ESF. Develop

P&S Account No. - 1.2.3.3.1.2.4 OG -Percolation in the Unsaturated Zone - ESF Study

Statement of Work (cont.):

detailed testing procedures that can be followed during bulk permeability testing in the ESF. Assess time required to complete each phase of testing within the ESF. Drill and core seven sets of short radial boreholes and six sets of long radial boreholes. Conduct on-site logging and description of cores and drill cuttings and water content measurements. Conduct detailed laboratory examination of cores and determination of hydraulic properties. Conduct borehole television surveys and geophysical logging of well bores. Conduct in situ steady state and transient pressure test and interference tests. Conduct borehole instrumentation and monitoring of temperature, atmospheric pressure, humidity and matric potential. Conduct gas sampling from radial boreholes. Evaluate hydrogeologic unit contacts by cross hole pneumatic and hydraulic tests. Drill and core 12 vertical and 6 inclined holes in each of the (1) upper breakout room, and (2) main test level. Conduct borehole deviation survey, television-fracture logging and geophysical surveys. Conduct cross hole pneumatic and hydrologic tests. Monitor stress-strain within boreholes. Develop hydrologic and mechanical numerical models for the prediction of permeability changes around repository openings. Conduct borehole geophysical surveying. Conduct cross-hole permeability testing. Monitor stress-displacement in boreholes. Develop a combined hydrologic-mechanical model to use in the ES Excavation Effects Test. Measure shaft wall seepage and install blockouts for later instrumentations. Conduct seepage water sampling by container or lysimeter and pore water sampling from core by extraction. Conduct large flow measurements by stop watch and container, flow meter, or weir. Drill and core holes into perched water zone. Instrument boreholes with some combination of pressure transducers, lysimeters, tensiometers and heat dissipation probes. Conduct pump test of any perched water zone with sufficient flow. Conduct water sample analysis. Develop lateral dry drilling methods needed to tap water seeps. Develop necessary plumbing to make hydraulic head measurements and collect representative water samples. Develop necessary instrumentation and equipment to monitor long-term changes in hydraulic head and flow rate. Determine how hydrogeologic conditions affect flux, flow paths, and travel time in the rock which lead to the development of perched-water zones. Determine if these perched-water zones can be identified as transient or permanent in nature. Collect gas-composition samples, carbon-13/carbon-12 ratio samples, carbon-14 samples and water vapor samples from radial boreholes. Prepare and analyze samples. Collect and transport core and rubble samples. Conduct water extraction from samples and chemical and isotopic analysis. Drill and core one borehole in the vicinity of each of two exploratory shafts and possibly a third hole in between. Run borehole deviation survey, geophysical logs, thermal survey and video surveys. Determine lithology, hydrologic unit contacts, fracture frequency spacing and orientation, and gravimetric moisture content. Collect and analyze perched water samples. Conduct gas sampling and analysis from selected packed-off intervals. Determine bulk pneumatic permeabilities of selected intervals by packer nitrogen-injection tests. Conduct perched water zone flow rate measurements and aquifer tests (if feasible). Determine hydraulic properties of major faults or fault zones encountered in the ESF. Conduct air permeability tests between boreholes across fault zones. Conduct cross-hole water-injection tests tagged with tracer. Obtain core samples and perform various analysis on samples. Participate in ESF test planning. Measure temperatures in quasi-horizontal boreholes in the ESF. Provide data to activity 8.3.1.15.2.2.1.

Conduct laboratory determination of the hydraulic properties of the rock matrix. Conduct computer modeling of fluid flow in discrete fractures. Design and implement a local data acquisition system (DAS) which will record the collected data from the instrumented core, flow metering system and the test apparatus. Conduct laboratory and in situ experiments to evaluate the applicability of psychrometers, tensiometers, conductivity probes and time domain reflectometry for characterizing the moisture state of fractured tuff, including moisture front detection, and redistribution and steady state monitoring. Conduct borehole instrumentation and monitoring of temperature, atmospheric pressure, humidity and matric potential. Measure shaft wall seepage and install blockouts for later instrumentations. Conduct seepage water sampling by container of lysimeter and pore water sampling for core by extraction. Instrument boreholes with some combination of pressure transducers, lysimeters, tensiometers, and heat

P&S Account No. - 1.2.3.3.1.2.4 OG -Percolation in the Unsaturated Zone - ESF Study

Statement of Work (cont.):

dissipation probes. Develop necessary instrumentation and equipment to monitor long term changes in hydraulic head and flow rate. Conduct water extraction from samples and chemical and isotopic analysis. Obtain core samples and perform various analyses on samples. Conduct air relative humidity, temperature, and other measurements to determine boundary conditions controlling air and water movement with rock near the ESF.

Activities for FY 1997 include:

Conduct air-permeability and hydrochemistry testing in boreholes cored from access drifts and alcoves excavated into the Ghost Dance fault from the Main Drift of the ESF. Testing that will be conducted in the cored boreholes will include, as appropriate, (1) temperature and heat-flow surveys, (2) geophysical logging, (3) pneumatic pressure monitoring, (4) gas sampling for chemical analysis, and (5) single-hole and cross-hole air-permeability testing. Collaborate with technical personnel from LBNL to prepare a detailed plan, based on existing approved DOE Study Plans as applicable, to conduct in situ field tests within the ESF and to perform associated analyses and interpretations to estimate the present-day rate and spatial distribution of percolation flux across the potential repository horizon. This testing program within the ESF is planned to be initiated in FY 1998 and to be completed in FY 1999. Monitoring of air pressure, temperature, and humidity will be continued at selected stations within the ESF in order to develop a water mass balance for moisture in the ESF. Limited observations and analyses of water loss from exposed rock surfaces within the ESF will be conducted.

ESF Drift Scale Flux and Niche Study -- Provide assistance to LBL in conducting experiments to: (1) Measure field scale permeability of repository rock for use in the UZ site-scale model and UZ drift-scale submodel, (2) Determine the threshold of flow into drift with finite liquid pulse release to represent the arrival of episodic fast flow to the repository horizon, and (3) Quantify interaction and monitor fast flow paths and non-fast flow pathway zones. (See OG33124FBH Summary Account Statement of Work).

Phase 1 of Ptn Lateral Diversion -- Evaluate the potential for lateral diversion of downward percolation water under present conditions and possible wetter conditions in the nonwelded Paintbrush Tuff (Ptn) based on measured properties and conditions of the rocks exposed in the north ramp of the ESF and evaluation of samples, about 2 meters in length, from about 20 boreholes drilled from the ESF (see OG33124FBG Summary Account Statement of Work).

South Ramp Hydrology -- Data will be collected to evaluate the hydrologic conditions of the south ramp of the ESF and role of faults in controlling hydrologic behavior, especially in the nonwelded Paintbrush Tuff (see OG33124FBF Summary Account Statement of Work).

Activities for FY 1997, 1998, and 1999 include:

Continue air-permeability and hydrochemistry testing in boreholes cored from access drifts and alcoves excavated into the Ghost Dance fault from the Main Drift of the ESF. Testing that will be conducted in the cored boreholes will include, as appropriate, (1) temperature and heat-flow surveys, (2) geophysical logging, (3) pneumatic pressure monitoring, (4) gas sampling for chemical analysis, and (5) single-hole and cross-hole air-permeability testing. Conduct activities required to meet Level 3 Milestone SP3500M3, "Initiate North GDF Alcove Testing," and Level 3 Milestone SP3507MC, "Initiate South GDF Alcove Testing." Prepare Level

Prepared - 07/02/97:07:47:31 | Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.4 0G -Percolation in the Unsaturated Zone - ESF Study

Statement of Work (cont.):

3 Milestone Report SP3515M3 due 09 December 1998 describing the results of air-permeability and hydrochemical testing conducted in the Ghost Dance Fault test alcoves and conducted in other test alcoves and test locations within the ESF from 01 October 1996 through 30 September 1998. Air-permeability and hydrochemistry testing initiated in other ESF test alcoves and locations in FY 1996 or later will be completed.

Support design basis modeling by participating in a group effort to abstract precipitation, infiltration, and percolation models and data.

Insert Attachment A1 Rec'd 7/2/97

Summary Account	Title
0G33124E96	Air-Permeability and Hydrochemistry Testing in the
0G33124F96	Perched Water Testing in the Exploratory Studies
0G33124FA1	Support E&I Design Basis Modeling
0G33124FB7	Air Permeability & Hydrochem Testing ESF
0G33124FB8	Percolation Flux across Repository Horizon
0G33124FBA	Moisture Monitorning in the ESF
0G33124FBB	Air-Permeability & Hydrochem Testing ESF
0G33124FBD	Moisture Monitoring in the ESF
0G33124FBF	South Ramp Hydrology
0G33124FBG	PTn Lateral Diversion (Phase I)
0G33124FBH	ESF Drift Scale Flux and Niche Study
0G33124GA1	Support E&I Design Basis Modeling
0G33124GB8	Percolation Flux across Repository Horizon
0G33124K96	ESF Moisture/Dryout
0G33124GBA	Infiltration of Construction Water in the ESF

Rec'd 7/2/97

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SP3505M3	Initiate South GDF Testing Geothermal Borehole Criteria - This milestone will be fulfilled by submission of a letter to the YMSCO documenting the start of testing in the geothermal borehole drilled across the fault in the access drift leading to the Southern Ghost Dance Fault Alcove. The letter will state the time and date of test initiation. The deliverable will be submitted in accordance with YAP5.1Q.	18-Apr-97
SP3505M5	(YAR) Initiate South GDF Tst Geothermal Borehole Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within	16-May-97

Prepared - 07/02/97:07:47:31 | Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.4 0G -Percolation in the Unsaturated Zone - ESF Study

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SP3505M5	30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	
SP3500M3	Initiate North GDF Alcove Testing Criteria - This milestone will be fulfilled by submission of a letter to YMSCO documenting that testing is initiated in the first borehole in the North Ghost Dance Fault Alcove. Testing is defined as obtaining the first temperature log in the borehole. The letter will state the time and date of test initiation. The deliverable will be submitted in accordance with YAP5.1Q.	16-May-97
SP3500M5	(YAR) Initiate North GDF Alcove Testing Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	16-Jun-97

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig	7/2/97	Dennis R. Williams	8/12/1997	R. D. HABBE	8-13-97

Preparer - Signature	Technical Reviewer - Signature	QA Reviewer - Signature	Date
Robert W. Craig		RD Habbe	

RMC
7/2/97

WBS 1.2.3.3.1.2.4
Percolation in the Unsaturated Zone - ESF Study
ATTACHMENT A

Provide a predictive analysis of the hydrologic and physical conditions expected along the Cross Drift and (2) sample and instrument the Cross Drift in order to collect data to evaluate and characterize the range and variability in water status (water potential and water content) and hydrologic properties in the Cross Drift, and then to evaluate the accuracy of the pre-excavation predictions of hydrologic conditions and properties. The data obtained and analyses performed will provide (1) information on the spatial distribution of the hydrologic conditions leading to the identification of flow pathways and estimation of the spatial distribution of flux into the repository horizon, (2) a detailed database of the spatial distribution and variability of physical and hydrologic properties of the repository horizon, (3) possible identification and location of fast and/or preferential flow pathways through isotopic and hydrologic analysis. This study is in support of evaluating the attribute of the DOE Waste Containment and Isolation Strategy concerned with the rate of water seepage into the potential repository.

Determine in situ the pneumatic properties of and gas-chemistry within and across structural features, including the Solitario Canyon fault, within the unsaturated zone. These data, analyses, and interpretations will be used as input to and as constraints on revisions to the site-scale unsaturated-zone flow model that is being developed. Air-permeability and hydrochemistry testing will be conducted in boreholes cored across the Solitario Canyon fault from an access drift or alcove.

In collaboration with LBNL, (1) determine the moisture balance within the Cross Drift, (2) determine the effects of TBM water use and ventilation on the water balance and water status surrounding the Cross Drift, and (3) estimate the relationship of TBM water use with dust control and percolation of applied water away from the tunnel. These data will provide initial and boundary conditions for the site-scale unsaturated-zone flow model as well as large-scale in-situ moisture flow in the rock mass near the Cross Drift in support of evaluating the attribute of the DOE Waste Containment and Isolation Strategy concerned with the rate of water seepage into the potential repository.

Use the downward infiltration of bromine-spiked J-13 construction water in the ESF as the basis for a long-term tracer test for studying fracture-matrix interaction in the unsaturated zone. In addition to containing the bromine tracer, the construction water has unique measurable isotopic compositions that can also be used as tracers. Because of evaporation due to the ventilation system, construction water infiltrating the rock mass below the inverts will be strongly enriched in deuterium and oxygen-18. Consequently the isotopic composition of this water will be unique compared with any native water in the rock mass; thus it will be easily detectable as a plume of isotopically "heavy" water moving downward in fractures and the matrix. Because the degree of isotopic enrichment is a direct function of the degree of evaporation (Raleigh fractionation law), these data will also be used to constrain the construction water budget, i.e. the isotopic composition of the infiltrating water will indicate how much water has been lost to evaporation.

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System PACS Participant Work Station (PPWS) Participant Planning Sheet (PSA03)	01-May-97 to 31-May-97 Page - 1
Prepared - 07/02/97:11:52:49		Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.3.1.2.6 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Gaseous-Phase Movement in the Unsaturated Zone	BASELINE Finish Date	- 09/30/96
WBS No.	- 1.2.3.3.1.2.6		
WBS Title	- Gaseous-Phase Movement in the Unsaturated Zone	Element ID	- OG33126

	Fiscal Year Distribution											
	Prior	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Future	At Complete
Annual Budget	0	150	0	~~279~~	279	0	0	0	0	0	0	0	429 150

Statement of Work: Rec 7/2/97

Rec 7/2/97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

Measure air circulation in open boreholes using anemometers and propeller anemometers, temperature probes and relatively humidity probes. Determine contribution to flow by periodic logging to assess depth profiles of air-flow velocities, temperature and rock-gas composition. Conduct flow interferences tests between wellbores. Conduct gas tracer tests: divergent flow, divergent-convergent flow and convergent flow. Develop gas-phase model by 3-D finite difference numerical method.

QARD applies to this effort.

Participant agrees to perform tasks and activities as described in subordinate FY96 Summary Accounts.

Rec 7/2/97

FY 1999 Activities:

Install a Seamist liner in boreholes SD-11 and SD-13 to allow monitoring of uz pressure response to daily barometric change. This will allow for further constraint and understanding of gas phase circulation in Yucca Mountain.

Summary Account	Title
OG33126896	Gas Circulation and Pneumatic Pathways

ela 7/2/97

0633126 6B1 Gas Phase Movement in the Unsaturated Zone. DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
3GGP605M	Synthsis Gas Phase Circultion in the ESF Criteria - This Level 3 milestone will consist of a synthesis report describing the results and interpretation of all data and observations, tests, and samples for all gas-phase tracer tests, shut-in tests, flow surveys and monitoring, and gas sampling performed in the vicinity of the Exploratory Studies Facility collected and analyzed through July 1996. This report will describe the ambient conditions of gas phase circulation prior to Exploratory Studies Facility excavation, along with any identifiable changes that occur as a result of excavation of the Exploratory Studies Facility. This report will provide information critical to the understanding of how fluids move through the unsaturated zone, time of travel of gases moving through the unsaturated zone, how Exploratory Studies Facility excavation may effect fluid movement. Level 4 milestone 3GUS600M, due 28 June 1996, will provide information for this deliverable. It will describe the results and interpretation of all observations, tests, and samples for each occurrence of perched water or moist rock zones in the Exploratory Studies Facility or in any boreholes drilled in the vicinity of the Exploratory Studies Facility. Water chemistry and hydraulic characteristics of the perched reservoir or moist rock zone will be described. Also included if possible, will be projections of where perched water may occur in or beneath the Main Drift and South Ramp of the Exploratory Studies Facility. This milestone	28-Aug-96

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.6 OG -Gaseous-Phase Movement in the Unsaturated Zone

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
3GGP605M	will provide information critical to the understanding of the hydrogeologic conditions causing the accumulation of perched water, whether perched water is a transient or permanent feature; and the implication of a perched reservoir on flux, flow paths, and travel time. The stratigraphy used in the report will be consistent with the Reference Information Base Section 1.12(a), "Stratigraphy: Geologic/Lithologic Stratigraphy" and the Three Dimensional Model (YW85) of September, 1995. The use of Q and non-Q data in the deliverable will be clearly identified. Record accession numbers and Automated Technical Data Tracking numbers will be included, as appropriate, for all data used and/or cited in the deliverable. The deliverable will be submitted to YMSCO in accordance with YAP 5.1Q.	

Approvals

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig	7/2/97	Dennis R. Williams	8/12/1997	R. D. HABBE	8-13-97
Preparer - Signature		Technical Reviewer - Signature		QA Reviewer - Signature	Date
Robert W. Craig				RD Habbe	

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
	PACS Participant Work Station (PPWS)	Page - 1
Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.3.1.2.7 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Unsaturated Zone Hydrochemistry	BASELINE Finish Date	- 09/30/97
WBS No.	- 1.2.3.3.1.2.7		
WBS Title	- Unsaturated Zone Hydrochemistry	Element ID	- OG33127

	Fiscal Year Distribution											
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
Annual Budget	550	260	0	255	0	0	0	0	0	0	0	0	1065 810

Statement of Work: Rec 7/2/97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Collect gas samples for gas composition, carbon-13/carbon-12 ratios, carbon-14 and water vapor analyses. Prepare and analyze samples. Collect, preserve and transport core samples. Conduct extraction of water samples from core by triaxial and uniaxial compression, high speed centrifuge, vacuum distillation and immiscible displacement. Conduct analyses and age dating of water samples. Interpret data and write-up reports.

Activities for FY 1997 include:

Pore water will be extracted from core samples from surface boreholes (SD-7, SD-9, SD-12, and NRG-7a) and boreholes drilled in ESF alcoves, particularly those excavated into the Ghost Dance Fault from the ESF Main Drift and drift scale test area. Pore-water extraction will be performed by one-dimensional compression or vacuum distillation. Water samples will be analyzed for cations, anions, stable isotopes, tritium, and carbon-14. Results of chemical analyses of pore water obtained from ESF core samples will be compiled and a data package will be prepared and submitted to the Records Processing Center.

A memorandum will be prepared and submitted to the USGS TPO documenting results and submittal of the data analyses to the TDB. A comparison of existing UZ hydrochemical data and data collected during the heating phase of the Single-Element Heater test will be made.

→ Insert Attachment A Rec 7/2/97

Summary Account	Title
OG33127B96	Unsturated-Zone Hydrochemistry
OG33127FBA	UZ Hydrochemistry
OG33127FBB	UZ Hydrochemistry

Rec 7/2/97 OG33127BB2 Isotopic and Hydrochemical Studies of UZ gas and water DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SP1137AM3	Insert Attachment B Rec 7/2/97	

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
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Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.2.7 OG -Unsaturated Zone Hydrochemistry

Approvals

Robert W. Craig	7/2/97	Dennis R. Williams	8/12/1997	R. D. Habbe	8-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig				R D Habbe	
Preparer - Signature		Technical Reviewer - Signature		QA Reviewer - Signature	Date

RLC
7/2/97

WBS 1.2.3.3.1.2.7
Unsaturated Zone Hydrochemistry
ATTACHMENT A

Pore water from nonwelded core will be obtained by uniaxial compression and analyzed for major dissolved ions, stable and radiogenic isotopes, tritium and C-14.ages. Pore water from densely welded units will be extracted by vapor distillation for tritium, C-14 of extracted carbon dioxide gas, and stable isotope (D/H and O-18/O-16) analyses. Radiogenic isotope analyses (Sr and U) will be obtained on densely welded units by leaching of pore water salts using high-purity deionized water. The principal objectives of this analytical work are to further overall understanding of percolation through the unsaturated zone including its spatiotemporal variability, percolation flux at the repository horizon, quantify travel time, and elucidate the relationship between fracture and matrix flow. These data contribute importantly to the UZ flow model to be used in the TSPA-LA. Core obtained in the drilling of ECRB bore holes SD-11 and SD-13 will provide improved sampling for these key measurements, and the results will greatly enhance the existing data base of information on UZ pore water ages, compositions, and nature of flow.

Rec 7/2/97

WBS 1.2.3.3.1.2.7 Unsaturated Zone Hydrochemistry
ATTACHMENT B

SPH37AM3 Report: Unsaturated Zone Pore Waters 15-sep-99

This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR).

This level 3 milestone report will consist of a detailed technical report that will synthesize previously reported and new data on pore waters in the unsaturated zone. the report will be comprehensive and will supersede all previous level 4 reports on the subject. It will include a detailed interpretive section describing the key implications of the data sets with regard to flux to the repository horizon and from the repository horizon to the water table, flow velocity and its spatial variation, and interaction of matrix and fracture water.

This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature cited in the deliverable shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. The report shall note data used and shall include record Accession Numbers or Data Tracking Numbers when available. This deliverable shall be processed in accordance with YAP-5.1Q. This deliverable is complete when it is logged into the TRM database.

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
	PACS Participant Work Station (PPWS)	Page - 1
Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.3.1.3.1 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Site Saturated Zone Ground-Water Flow System	BASELINE Finish Date	- 05/04/99
WBS No.	- 1.2.3.3.1.3.1		
WBS Title	- Site Saturated Zone Ground-Water Flow System	Element ID	- OG33131

					Fiscal Year Distribution							At
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	Complete
Annual Budget	1150	852	150/250	75/584	0	0	0	0	0	0	0	0	2827/2836

Statement of Work: RWA 7/2/97

RWA 7/2/97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Conduct borehole geophysical surveys including gyroscopic surveys, vibrioses surveys, optical television surveys and dielectric gamma-ray spectrum, caliper, fluid density, electric density and epithermal neutron logs. Drill an additional 10 wells to complement existing 25 wells for water-level monitoring. Conduct lithologic and geophysical logging of wells. Conduct water sampling for chemical and isotopic analyses. Install pressure transducers and continuous water-level monitoring and aquifer-test monitoring. Install borehole dilatometers to detect water-level changes due to a seismic fault creep events of slow earthquakes. Analyze, interpret and model intraborehole flow with tracer injector surveys and temperature logs. Analyze and interpret injection and withdrawal aquifer stress tests. Conduct barometric and earthtide analysis of water-level fluctuations. Conduct seismic surveys to map fractures or faults between the C-Holes. Conduct selected interval cross-hole pumping tests. Conduct 30 day pumping and recovery test. Conduct well test analysis and characterization. Conduct drift-pumpback test. Conduct two-well recirculating test. Conduct convergent test. Analyze test and describe characteristics observed. Conduct single well tests for 5-10 wells down gradient by drift-pumpback test method and collection of samples. Conduct possible multiple well test for two-well circulation or two-well convergent test. Analyze test results and describe solute-transport characteristics.

Activities for FY 1997 include:

Interact with Los Alamos National Laboratory (LANL) and the Management and Operating Contractor (M&O) to plan and define hydraulic, conservative tracer, and reactive tracer tests to be conducted through 14 March 1997. Provide M&O with detailed plans and required field support for hydraulic and conservative tracer tests to be conducted in FY 1997.

As appropriate, complete hydraulic and conservative tracer tests at the C-Hole complex with the pump and packer configuration as it exists on October 1, 1996.

Prepare a memorandum describing testing completed during the period 01 July 1996 through 31 December 1996.

Compile data collected during hydraulic and tracer tests in FY-1997 through December 1996, index and review data, and submit to Records Processing Center.

Prepare report on hydraulic and conservative tracer tests at the C-Holes complex.

Continue to process report on hydraulic and conservative tracer tests at the C-Holes complex following submittal to Department of Energy and USGS Director. Respond to comments so report may be published at a later date if desired.

Prepare and submit to the Records Processing Center a data package containing previously unreported hydraulic and conservative

Prepared - 07/02/97:07:47:31 | Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.3.1 OG -Site Saturated Zone Ground-Water Flow System

Statement of Work (cont.):

tracer test data obtained through 14 March 1997 at the C-Hole complex.

Prepare letter report on results of hydraulic and conservative tracer tests performed at the C-Hole complex through May 1997. Get letter report reviewed and submit to Department of Energy.

Conduct manual water-level measurements in approximately 22 boreholes on a quarterly basis using either calibrated steel tapes or calibrated borehole logging equipment. Calibrate measuring equipment currently in use on an annual basis. If resources permit and data appear to be useful, conduct more frequent measurements in boreholes recently pumped or near boreholes being pumped.

Compile data collected in calendar year 1996, review data, and submit to Records Processing Center.

Complete report on data collected during calendar year 1995. Submit report to USGS Director and Department of Energy.

Activities for FY 1997 and FY 1998 include:

Conduct manual water-level measurements in approximately 22 boreholes on a quarterly basis using either calibrated steel tapes or calibrated borehole logging equipment. Calibrate measuring equipment currently in use on an annual basis. If resources permit and data appear to be useful, conduct more frequent measurements in boreholes recently pumped or near boreholes being pumped.

C-Wells Hydrology and Tracer Tests -- Conduct field experiments at C-Hole complex to obtain hydraulic and transport properties to support development, calibration and testing of the site-scale SZ flow and transport models (see OG33131FBB Summary Account Statement of Work).

WT Eh and Ph Measurements -- Existing water chemistry data will be evaluated and used to provide input to hydrochemical flow-path models. The USGS will assist the M&O in obtaining new water samples from WT-17 for geochemical analyses (see OG33131FBF Summary Account Statement of Work).

Compile data collected in calendar year 1997, review data, and submit to Records Processing Center.

Complete report on data collected during calendar year 1996. Submit report to USGS Director and the Department of Energy.

RLC
7/2/97 → Activities for FY1998 and FY1999 include:
Insert Attachment A

Summary Account	Title
OG33131A96	Conduct Hydraulic/Tracer Tests, C-Wells
OG33131F96	Site Potentiometric Levels Monitoring
OG33131FBA	C-Well Complex Hydraulic & Conservative Tracer Te
OG33131FBB	C-Well Complex Hydraulic & Tracer Test
OG33131FBC	Water-Level Monitoring
OG33131FBD	Water-Level Monitoring
OG33131FBF	WT Eh & Ph Measurements

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.3.1 0G -Site Saturated Zone Ground-Water Flow System

Statement of Work (cont.):

0G33131G96	Pumping and Testing Existing Monitoring Wells
0G33131GA3	Planning for STC SZ Confirmation Studies
0G33131GB1	Water-Level Monitoring
0G33131K96	Enhanced C-Wells Hydraulic and Conservative Tracer

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SP23PM3	Results of Hydraulic & Tracer Tests C-Hole Compl Criteria - This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR). This report will present the results of Saturated-Zone (SZ) hydraulic and tracer tests conducted by the USGS at the C-Holes complex through 31 May 1997. The report will describe the tests that were conducted in the Lower Bullfrog interval, present the results of the tests, describe the analyses performed on the test data, and interpret the test data and analyses with respect to the determination of hydraulic and transport properties and parameters, including explicit discussion and evaluation of the uncertainties associated with the data and analyses. The data, analyses, and interpretations presented in this deliverable will be used, as appropriate, to continue development, refinement, and testing of the site-scale SZ ground-water flow model. This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature cited in the deliverable shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. The report shall note data used and shall include record Accession Numbers or Data Tracking Numbers when available. This deliverable shall be processed in accordance with YAP-5.1Q. This deliverable is complete when the report is delivered to DOE and logged into the TPM database.	01-Aug-97
SP23PM5	(YAR) Results Hydr & Tracer Tests C-Hole Compl Criteria - This milestone consists of completion of the YMP Deliverable Acceptance Review (YAR) form initiated during processing of the named deliverable in accordance with YAP 5.1Q. The YAR will be completed and returned to Technical Publications Management (TPM) within 30 calendar days of receipt of the deliverable associated with this YAR. This milestone shall be considered complete when (1) the Contracts Officer Representative (COR) accepts the associated deliverable and (2) the YAR documenting COR acceptance is received by TPM. If the named deliverable is delayed, the deliverable due date for this YAR milestone will be delayed a corresponding number of days.	29-Aug-97

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
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Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No. - 1.2.3.3.1.3.1 OG -Site Saturated Zone Ground-Water Flow System

Approvals

Robert W. Craig	7/2/97	Dennis R. Williams	8/12/1997	R. O. HABBE	8-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert W. Craig				RO Habbe	
Preparer - Signature		Technical Reviewer - Signature		QA Reviewer - Signature	Date

RWC
7/2/97

WBS 1.2.3.3.1.3.1
Site Saturated Zone Ground-Water Flow System
ATTACHMENT A

In FY 1998 and FY 1999, water samples from saturated zones (perched and regional) in SD11 and SD13 will be collected systematically for major and minor dissolved ion and isotopic analyses, and initial analyses will be conducted for selected dissolved materials. Objectives are (1) to determine whether the first saturated zone encountered is perched or part of the regional saturated system, (2) to elucidate the age and origin of the water if perched, (3) to determine the residence time of water in the saturated zone, (4) to determine the degree of mixing (isotopic and chemical uniformity) of the upper part of the saturated zone, (5) to detect any potential recharge in the uppermost part of the saturated zone, and (6) to detect potential trace element plumes that may emanate from up gradient mineralized zones in the caldera rocks north of Yucca Mountain (such a plume could be used to determine effective dispersion in SZ beneath the repository block).

For 1999, support pre-construction, during and post-construction saturated-zone hydrologic monitoring and testing of boreholes USW SD-11 and USW SD-13 (FY99). Activities connected with this study include conducting necessary borehole hydraulic tests to determine the hydrologic properties of the saturated zone, determining borehole formation properties, collecting and analyzing fluid samples, and providing interpretation of test results. Prepare associated data reports and interpretive reports on the results of borehole hydraulic testing. Conduct perched-water testing in boreholeUSW SD-13. Work will consist of monitoring the borehole during construction for the occurrence of perched water and conducting the necessary borehole hydraulic tests to determine the nature of any perched water encountered in the borehole.

Participant USGS	Yucca Mtn. Site Char. Project-Planning & Control System	01-May-97 to 31-May-97
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Prepared - 07/02/97:07:47:31	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No.	- 1.2.3.6.2.2.1 OG	BASELINE Start Date	- 10/02/95
P&S Account Title	- Quaternary Regional Hydrology	BASELINE Finish Date	- 09/30/99
WBS No.	- 1.2.3.6.2.2.1		
WBS Title	- Quaternary Regional Hydrology	Element ID	- OG36221

					Fiscal Year Distribution							At
	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	Complete
Annual Budget	1105	1151	~~862~~ 1303	~~500~~ 1020	0	0	0	0	0	0	0	0	~~3618~~ 4579

Statement of Work:

RWC 7/2/97

RWC 7/2/97

All quality affecting work included within this scope shall be identified and controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Conduct mapping, and stratigraphic analyses supported by trenching alluvial deposits, where necessary, in channels north and south of Coyote Wash and throughout the vicinity of the NTS. Evaluate erosion scars, stone stripes, and other debris deposits in regard to their formative geomorphic processes. Conduct field and photo-reconnoitering in areas of concern to select best techniques for dating surfaces. Conduct dating of alluvial surfaces and unconsolidated stream-channel deposits. Evaluate evidence of paleo-flooding for comparison with magnitudes and frequencies of historical floods. Characterize unsaturated zone hydrochemistry from chemical and isotopic water analyses to determine climatic conditions of past recharge and flow paths. Estimate infiltration and percolation rates, residence and travel times from isotopic data of tritium, carbon-14 and chlorine-36. Analyze and verify LANDSAT multispectral and thematic scanners, high and low altitude aerial photography, low altitude thermal scanner and side looking airborne radar. Determine location of discharge deposits, distribution of geomorphic/geologic deposits, distribution of vegetation types and communities and location of hydrologically favorable features e.g. fracture zones, playas and fans. Estimate character of ground-water discharge through analysis of samples obtained by core drilling, hand augering, or outcrop sampling and through geophysical logging. Conduct geochemical analysis and thermal measurements of modern discharge waters. Conduct paleontological analysis of sediments in modern and past discharge areas. Conduct paleontological evaluation of ostracode ecology plus chemical and isotopic analysis of ostracode valves. Estimate past potentiometric levels by evaluation of carbonate caverns and spring deposits as well as cores. Determine present potentiometric head and boundaries of sub-basin from EM ground surveys. Conduct meteorological monitoring at analog recharge sites. Conduct chemical and isotopic measurement of precipitation at sites. Characterize vegetative cover for remote-sensing techniques. Conduct stream gauging measurements for the development of a water budget. Compare modern pack rat midden and plant assemblages with similar macrofossil data at NTS site. Estimate recharge by chloride-ion mass-balance model. Estimate recharge by precipitation-runoff modeling. Measure unsaturated zone chemistry and hydrologic characteristics. Develop and test unsaturated zone mass-balance model. Conduct meteorological monitoring at arid zone geochemical site. Conduct hydrologic monitoring at arid zone geochemistry site. Characterize soil at arid zone geochemistry site. Conduct soil dating at arid zone geochemistry site. Develop and verify climate/soil transport model. Conduct field investigations involving sampling, trenching, mapping, angle and vertical drilling, and coring to determine vertical extent and characteristics in Trench 14. Conduct mineralogical test and analyses to place limits on conditions for deposition of vein-like deposits in vicinity of Yucca Mountain and to provide basis of comparison to other vein deposits of known origin. Conduct geochemical tests in support of mineralogical studies consisting of major, minor and trace element compositional analysis. Conduct fluid inclusion studies to determine temperature of formation and chemical composition of fluid. Determine geochronology by isotopic age dating. Conduct tracer and stable isotope investigations to place constraints on the origin of the deposits. Interpret temperature and water chemistry from microfossil assemblages. Develop 3-D numerical model of hydrologic systems to test conceptual models of past flow in vicinity of Trench 14.

Activities in FY 1997 and Fy 1998 will include:

P&S Account No. - 1.2.3.6.2.2.1 OG -Quaternary Regional Hydrology

Statement of Work (cont.):

Completion of field investigations at paleo-discharge sites near Yucca Mountain (southern Crater Flat, Amargosa Desert, and Fortymile Wash fan toe) to identify and document stratigraphic sections that provide a framework of time-dependent depositional variations.

Perform uranium-series disequilibrium dating, thermoluminescence dating, and radiocarbon dating on materials deposited from hydrogenic, eolian, and biogenic materials to establish a defensible chronology for this stratigraphic framework.

Perform stable isotope analyses (carbon and oxygen) and radiogenic isotope analyses (strontium and uranium) from hydrogenic materials to establish origins of the ground waters and likely physical parameters.

Collect and analyze samples of saturated-zone groundwater from wells upgradient from discharge sites in Crater Flat. These will include resampling well VH-2 and wells in the upper reaches of Crater Flat (GEXA wells) for more comprehensive isotopic and dissolved ion geochemistry. The water compositions will be speciated to determine if existing ground-water compositions are consistent with the types of deposits at the discharge sites.

Develop estimates of past percolation flux temporally and spatially distributed and will include the construction of scenarios describing the nature of the percolation with respect to variable climate input at the surface. Demonstration of a buffered or sluggish reponse to changing surficial conditions would be considered a very positive attribute of the site with regard to water flux through the repository block. In order to evaluate the connection between mineral deposition in fractures and cavities with surficial processes, tracer isotope (oxygen, carbon, strontium and uranium) studies of calcite and opal will be continued in parallel with the isotopic dating. Establishing a credible time framework of deposition will continue to involve high-precision thermal ionization mass spectrometric U-series dating dating with emphesis on minimal subsample sizes to maximize age resolution. The system 230Th-226Ra will be used to better constrain the depositional model used to interpret the ages. The work will also be extended to include high-precision U-Pb dating of opal occurrences embedded throughout the calcite fracture and cavity fillings to establish depositional rates of the calcite for input to the flux calculations. Preliminary analyses have already demonstrated the feasibility of dating the older opals by the U-Pb method. Samples will be collected and analyzed from the southern part of the north-south drift and from the south ramp. Samples collected along the south ramp will provide improved understanding of the nature and rates of percolation through the Tiva Canyon Tuff and and the role of the PTn (Paintbrush Nonwelded Hydrogeologic Unit) in controlling percolation through the Topopah Spring Tuff. Detailed line surveys will be conducted in concert with sample collection to provide quantitative determinations of the abundance of calcite and opal in TSw2 as intersected by the ESF.

Continue geochronological and isotope tracer studies of secondary hydrogenic minerals in fractures and cavities in the Exploratory Studies Facility as described in OG36221FB2 (Geochronology of Fracture-Filling Materials from the Exploratory Studies Facility and Estimates of Past Water Fluxes). The principal objectives continue to be development of independent estimates of the flux history in the repository block based upon the age distribution and abundance of calcite and opal deposits occurring in fractures and cavities in the repository block as encountered in the ESF. The study will continue to make and refine estimates of past percolation flux and will include the construction of scenarios describing the nature of percolation response in the rock mass to variable climate input at the surface. Demonstration of a buffered or sluggish reponse to changing surficial conditions would be considered a very positive attribute of the site with regard to water flux through the repository block. In order to evaluate the connection between mineral deposition fractures and cavities exposed by the ESF to surficial processes, tracer

Inc. Dollars in Thousands

P&S Account No. - 1.2.3.6.2.2.1 OG -Quaternary Regional Hydrology

Statement of Work (cont.):

Isotope (oxygen, carbon, strontium and uranium)studies of calcite and opal will be continued in concert with the isotopic dating studies. Establishing a credible time framework of deposition will continue to involve high-precision thermal ionization mass spectrometric U-series and U-Pb dating with emphasis on minimal subsample sizes to increase age resolution. This study will compile, synthesize, interpret existing geochronological data within the potential repository block including but not limited uranium-series, Cl-36, C-14, U-Pb, and tritium methods and prepare a level 3 report on this subject.
Activities in FY 1998 and FY 1999 will include: (Insert Attachment A)
RWC 7/2/97

Summary Account	Title
OG36221E96	Subsurface Mineral Record of Past Hydrology Using
OG36221F96	Sub-Surf Min. Records of Past Hydr. Ages/Tracer Ch
OG36221FB1	Evaluation of Paleo Ground-Water Discharge
OG36221FB2	Geo. Fract. Fill Mater, ESF & Est Past Water Fluxe
OG36221FB3	Syn.Dist.&Anal Geochron. Age Dets Potent Repos.Blk
OG36221G96	Evaluation of Paleo Ground-Water Discharge
OG36221GB1	Paleoclimate Confirmatory Analyses
OG36221K96	Dating of Fracture Coatings in ESF

DELIVERABLES RWC

Deliv ID	Description/Completion criteria	Due Date
	- Insert Attachment B 7/2/97	

Approvals

Robert W. Craig 7/2/97	Dennis R. Wenner 6/12/1997	RD HABBE 8/13/97
Preparer - print name Date	Technical Reviewer - print name Date	QA Reviewer - print name Date
Robert W. Craig		RD Habbe
Preparer - Signature	Technical Reviewer - Signature	QA Reviewer - Signature Date

Rec
7/2/97

WBS 1.2.3.6.2.2.1
Quaternary Regional Hydrology
ATTACHMENT A

Extend ongoing ESF studies of calcite and opal fracture fillings to similar deposits exposed along the ECRB cross drift. These low-temperature deposits are long-term records of percolation, and the new data will contribute to a better understanding and improved estimate of the spatiotemporal distribution of flux through the repository block.

The spatiotemporal distribution and abundance of calcite and opal in the ECRB cross drift will be predicted on the basis of data acquired from such deposits and their occurrence in the ESF. Zonal features (lithophysal vs. nonlithophysal), structural (faults and fractures) features, and surficial controls will be considered in developing this predictive capability. Estimates of calcite and opal in the ECRB will be based on 100 meter increments along the cross drift. A grading assessment of these predictions will be prepared at the end of the fiscal year.

Perform sample collection and documentation of calcite and opal occurrences, isotopic dating to establish depositional history (U-series, C-14, and U-Pb), isotopic characterization (O, C, Sr, U isotopes) to establish the nature of the precipitating fluids, and line surveys and systematic collection of dust in a specially designed dust collector mounted on the TBM near the cutter head to establish the spatial distribution and abundance of calcite and opal sequestered in fractures and cavities. Sampling and analyses will be closely coordinated with the LANL investigation of Cl-36, and USGS samples will be made available to LANL for specialized mineralogical and geochemical studies. The numerical age and isotopic data obtained for samples from the ECRB cross drift will be incorporated and interpreted with data obtained for samples from the ESF and from drill core.

Conduct sampling of fracture fillings from the Solitario Canyon fault alcove and other alcoves constructed in FY99 and complete numerical age and isotopic analyses of these samples and samples collected in FY98 from the ECRB cross drift The work will entail sample collection and documentation of calcite and opal occurrences, isotopic dating to establish depositional history (U-series, C-14, and U-Pb), and isotopic characterization (O, C, Sr, U isotopes) to establish the nature of the precipitating fluids and conditions of deposition. Sampling and analyses will be closely coordinated with the LANL investigation of Cl-36, and USGS samples will be made available to LANL for specialized mineralogical and geochemical studies. The numerical age and isotopic data obtained for samples from the ECRB cross drift, including the Solitario Canyon fault alcove, will be incorporated and interpreted with data obtained for samples from the ESF and from drill core.

RLC
7/2/97

WBS 1.2.3.6.2.2.1 Quaternary Regional Hydrology

ATTACHMENT B

SPC233M3 Report: Spatiotemporal Distribution of Percolation 15-sep-99

This deliverable shall include all information identified herein unless specifically exempted in writing by the COR at least 60 days before the scheduled due date (30 days in special cases agreed to by the COR).

The Level III milestone report will consist of a detailed technical report describing the spatiotemporal distribution of percolation through the repository block as indicated by calcite and opal fracture fillings. The report will synthesize previously reported and new data and will interpret the results of numerical dating and isotopic studies conducted on calcite opal and fracture fillings in the ESF and the ECRB cross drift. The report will be comprehensive and supersede all previous level 4 reports on this subject. The report will include a refined model of the spatiotemporal distribution of percolation through the repository block based on these data, and the model will be evaluated in the context of independent models of percolation derived from other data sets. In documenting the temporal distribution of calcite and opal deposits, the report will evaluate the relationship between depositional history and surficial climate variations to develop a predictive capability of the future variation of percolation as a function of climate change.

This deliverable shall be prepared in accordance with OCRWM approved quality assurance procedures implementing requirements of the Quality Assurance Requirements Description. The product shall be developed on the basis of the best technical data, including both Q and non-Q data. The Q status of data used and cited in the report shall be appropriately noted. Stratigraphic nomenclature cited in the deliverable shall be consistent with the Reference Information Base section 1.12 (a): Stratigraphy-Geologic Lithologic Stratigraphy. The report shall note data used and shall include record Accession Numbers or Data Tracking Numbers when available. This deliverable shall be processed in accordance with YAP-5.1Q. This deliverable is complete when it is keyed into the TPM database.

Part: M&O
Data - MOYMP
Prepared - 30-MAY-97:13:55:48

Yucca Mountain Site Characterization Project
Planning and Control System (PACS)
Participant Planning Sheet (PSA03)

Page - 1
Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.5.4.7 M&O

P&S Account Title - Supporting Calcula. for Postclsre Perfor. Analyses

PWBS Element Number - 1.2.5.4.7

PWBS Element Title - Supporting Calcula. for Postclsre Perfor. Analyses

Baseline Start - 01-feb-1996
Baseline Finish - 30-sep-1998

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
			Fiscal Year Distribution										
Annual Budget	183	250	181.0	68.8	0	0	0	0	0	0	0	0	682 435

Statement of Work

MK 6/9/97 MK 6/9/97 MK 6/9/97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

Perform analyses of potential test interference for surface-based and underground testing, evaluations of waste isolation implications of surface-based and underground testing; evaluations of the Title II design, construction, and operation of the ESF with respect to test interference and waste isolation; includes participation in ESF Title II design reviews; provide recommendations to ESF designers, surface-based and underground-testing with respect to construction, operation, and testing constraints, suggested changes in the ESF design, construction, and operation, and suggested changes in the testing program and in individual test details.

Summary Account	Title
TR547CO	FY1995 Carryover
TR547FA1	FY97 Performance Assessment Supt to DIE Activities
TR547GA1	FY98 Performance Assessment Support to DIE

MK 6/9/97

TR547GA2 Performance Assessment Support for ECRB - Phase II

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
	Perform waste isolation impact analyses of ECRB-related activities required for Determination of Importance Evaluations (DIEs), including revisions. These activities are the east-west drift, two surface-based boreholes along Yucca Crest, and associated testing and construction work. Provide support for ECRB-related Tracers, Fluids, and Materials (TFM) evaluations and Classification Analyses (CAs) with respect to waste isolation. Evaluate waste isolation impacts associated with the TBM special requirements in support of DIE prior to start of excavation of the main drift of the ECRB. Review implementation of DIE requirements through site visits; review of constructor submittals to A/E, drawings, specifications, field testing activities, job and field workpackages, and work programs.	MK 6/9/97

Approvals

Jean Younker	6/9/97	Dennis R. Williams	6/9/1997	R. D. HABBE	8-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Prep - signature		Technical Reviewer signature		QA Reviewer - signature	

Yucca Mountain Si terization Project
Planning and ol System (PACS)
Participant Planning Sheet (PSA03)

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.6.3.1.1 M&O

P&S Account Title - First Access Area

PWBS Element Number - 1.2.6.3.1.1

PWBS Element Title - First Access Area

Baseline Start - 01-oct-1995
Baseline Finish - 30-sep-1998

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
		Fiscal Year Distribution											
Annual Budget	268	~~570~~	0	0	0	0	0	0	0	0	0	0	~~838~~

Statement of Work 637 905

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

QARD applies to this effort.

Complete construction activities necessary to place the change house into operation. Operation is defined as operational showers and toilet facilities including the required support systems (heating, ventilation, and air conditioning, lighting, etc.).

Summary Account	Title
TR6311CO	FY1995 Carryover
TR6311EB1	Mothball Change House
TR6311EB2	Protect Switchgear Building
TR6311EB3	MAKE CHANGE HOUSE OPERATIONAL
TR6311FB1	Operational Change House
TR6311GB2	Complete Switchgear Bldg
TR6311GB3	Complete Permanent Yard and Laydown Area

ADD TR6311FB2 - DESIGN No. PORTAL SUPPORT FACILITIES

NOTE: ECRB REQUIRES A MUCK PILE DESIGN TO PROVIDE ADEQUATE STORAGE CAPACITY, CONSISTENT WITH DRAINAGE REQUIREMENTS.

+ MAS 7.8.97

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

Approvals

Robert M. Sandifer	7/3/97	JERRI J. ADAMS	8/18/97	R.D. HARBE	9-18-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date

Preparer - signature | Technical Reviewer - signature | QA Reviewer - signature

YMP-223-R0
09/18/95

Participant - M&O
Database - PROPOSED
Prepared -

Yucca Mountain Site Characterization Project
Planning and Control System (PACS)
Participant Planning Sheet (PSA04)

Contract -

Inc. Dollars in Thousands

P&S Account - 1.2.6.6.1.2.
P&S Account Title - TSL Exploratory Drifts Exc. ,Utilities ,& Equip
PWBS Element No. - 1.2.6.6.1.2.
PWBS Element Title - TSL Exploratory Drifts Exc. ,Utilities ,& Equip

BASELINE Start
BASELINE Finish 30-Sep-1998

QA - Yes

FISCAL YEAR DISTRIBUTION

Annual Budget

Prior	FY 97	FY 98	FY 99	FY 100	FY 101	FY 102	FY 103	FY 104	FY 105	FY 106	Future	At Complete
	~~3,258~~ 2153	~~14614~~ 2162	465									~~17872~~ 13620 BH 8/12/97

STATEMENT OF WORK

Design and construct the underground areas and service systems for the TSL Exploratory Drifts. NOTE: THE ECRB ACTIVITES INCLUDE ALL THE DIRECT WORK ELEMENTS NECESSARY TO EXCAVATE AND SUPPORT THE CROSS DRIFT.

Add work includes:

TR6612FB3 - Design ECRB Cross Drift
~~TR6612FB4 - TBM Mobilization and Rehabilitation~~ BMS 8-1-97
TR6612FB5 - Establish South Portal Access to Alcoves
TR6612GB2 - ECRB TBM Demobilization
TR6612GB5 - Excavate ECRB Launch Chamber
TR6612GB6 - Install Excavation Equipment
TR6612GB7 - Excavate ECRB Cross Drift

BMS 7-8-97

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
	SEE ATTACHMENT	

CONCURRENCE

Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert M. Sandifer	7/3/97	DENNIS R. WILLIAMS JERRI J ADAMS	8/12/1997	R D. HABBE	8-13-97
Preparer - signature		Technical Reviewer - signature		QA Reviewer - signature	

P+S Acct 1.2.6.6.1.2

ATTACHMENT TO PPS 1.2.6.6.1.2.

MILESTONES

SCM030M3 -Complete Launch Chamber Design- ~~05SEP97~~ 24 Oct 97 BWD 8-1-97
The ESF AE will complete the launch chamber design to support the near critical path activity for construction.. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

SCM040M3 - Complete the Design Cross Drift - ~~21NOV97~~ 09 Dec 97 BWD 8-1-97
The ESF AE will complete the design of the ECRB crossdrift. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

SCM110M3 - TBM on site - ~~19DEC97~~ 13 Feb 98 BWD 8-1-97
The ESF constructor will receive the rehabilitated ECRB TBM on site in preparation for assembly underground. into the data base. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

BWD 8-1-97
SCM050M3 - Complete Launch Chamber Excavation - ~~16DEC97~~ 05 Feb 98
The ESF constructor will compete the excavation and support of the launch chamber to prepare for the installation of electric and mechanical equipment needed to support excavation. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

BWD 8-1-97
SCM060M3 - Begin Cross Block Excavation - ~~12FEB98~~ 18 Mar 98
The cross block excavation will begin once the TBM becomes operational and begins to excavate. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

28+15 BWD 8-1-97
SCM120M3 - Complete Excavation across the Repository Block - ~~1JUN98~~ 11 Sept 98 BWD 8-1-97
The TBM shall reach Station ~~25+00~~ to complete the excavation across the potential repository block and Excavation across the Solitaro Canyon Fault, ~~will follow~~. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

RS Acct 1.2.6.6.1.2

8-1-97

SCM070M3 - Complete ECRB Construction - ~~90CT98~~ 20Jan99 3

The ECRB construction will be completed at the complete of the excavation of the ECRB alcoves. This event will be documented by a completion letter submitted to DOE in accordance with YAP5.1Q and will be considered complete when logged into the TPM data base.

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.6.6.1.3 M&O

P&S Account Title - Topopah Spring Level (TSL) Construction Test Supp.

PWBS Element Number - 1.2.6.6.1.3

PWBS Element Title - Topopah Spring Level (TSL) Construction Test Supp.

Baseline Start - 02-oct-1995
Baseline Finish - 30-sep-1998

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
	Fiscal Year Distribution												
Annual Budget	2684	5522	~~221~~	~~0~~	0		0	0	0	0	0	0	~~8427~~

Statement of Work 711 ~~2190~~ 1,300 * BMS 8-1-97 gjf 8/11/97 10396 10217 gjf 8/11/97 * BMS 8-1-97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

QARD APPLIES TO THIS EFFORT

Acceptance Criteria: Work will be measured through performance based audits and surveillances. Complete ESF Title II design of the Ghost Dance Fault exploratory drifts excavations, misc. Test alcove excavations, refuge chamber excavations, ground support, ventilation system, utilities, monitoring systems, and all other furnishings. Includes: supervision, development of BFD input, preparation of procurement and construction cost estimate, support for associated DIE, preparation of design change request documents, miscellaneous engineering support and design reviews. Constructability reviews w/CMO. Perform energy efficiency load ahalysis as required by DOE order 6430.1A. Provide labor, material and equipment to procure and construct the Exploratory Drifts including, but not limited to, drilling, blasting, all mechanical excavations, mucking operations, ground control, temporary utilities and ventilation, installation of rock bolting, wire mesh, shotcrete and fire wall, refuge rooms, test rooms, and alcoves. Provide labor, material and equipment to procure and construct permanent underground service systems including materials, equipment, and foundations required for the various utility, service, communications, and safety systems.

Summary Account	Title
TR6613EB1	Excavate Single Heater Test
TR6613EB10	ESF HEATED DRIFT
TR6613EB2	Excavate 1st Ghost Dance Fault Alcove
TR6613EB4	Single Heater Test Area/Driftscale Area
TR6613EB5	Design Alcove #6 - GDF #1
TR6613EB9	DCS
TR6613FB1	Complete Design Heated Drift
TR6613FB2	Excavate Thermal Test
TR6613FB3	Design Modifications for NGDF Drill Room
TR6613FB4	Complete NGDF Excavation
TR6613FB5	Heater Test Installation
TR6613FB6	Design Modifications for SGDF Drill Room
TR6613FB7	Excavate SGDF Alcove
TR6613FB8	AE Support to Thermal Test Installation
TR6613FB9	Design and Excavate Niches for ESF
TR6613FBA	Design Drift Scale Flux Test Niches
TR6613GB8	Design East-West Drift & Starter Tunnel

ADD TR6613GB1 - DESIGN ECRB ALCOVES
TR6613GB2 - EXCAVATE ECRB ALCOVES
TR6613GB3 - ECRB MAPPING & SAMPLING SUPPORT

NOTE: THE ECRB ACTIVITIES INCLUDE DESIGN, EXCAVATION, AND DIRECT LABOR SUPPORT TO THE SCIENTIFIC PROGRAMS

BMS X 7-8-97

gjf 8/11/97

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
SC2270M3	Complete Excavation of Thermal Test Alcove Criteria - Acceptance of the basic excavation and ground support by the CMO as being constructed in accordance with the approved drawing and specifications. Acceptance will be documented in the OCRWM daily report. Work	26-mar-1997

Inc. Dollars in Thousands (Esc.)

TR6613 Topopah Spring Level (TSL) Construction Test Supp. (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
	includes the cross drift, drill bay, plate loading niche, and the heated drift. YAP 5.1 does not apply in reporting the completion of this milestone	
SC2600M3	Complete Excavation of North Ghost Dance Fault Criteria - Acceptance of the excavated alcove by the CMO as being in accordance with the approved drawings and specifications. Acceptance will be documented in the daily report to OCRWM. YAP 5.1 does not apply to the reporting of this milestone.	30-apr-1997

Approvals

Robert M. Sandifer	7/3/97	JERRI J. ADAMS	7/11/97	R. D. HABBE	9-13-97
Preparer - print name	Date	Technical Reviewer - print name	Date	QA Reviewer - print name	Date
Robert M. Sandifer		Jerri J. Adams		R D Habbe	
Preparer - signature		Technical Reviewer - signature		QA Reviewer - signature	

Prepared - 1-JUL-97:13:34:29 Participant Planning Sheet (PSA03) Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.6.8.2 M&O

P&S Account Title - Exploratory Studies Facility (ESF) Construction Op

PWBS Element Number - 1.2.6.8.2

PWBS Element Title - Exploratory Studies Facility (ESF) Construction Op

Baseline Start - 01-oct-1995
Baseline Finish - 30-sep-1998

NON QA 8/11/97

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	Complete
		Fiscal Year Distribution											
Annual Budget	15025	~~15073~~	~~0~~	.8	0	0	0	0	0	0	0	0	~~30098~~
Statement of Work		~~17236~~ 15947	~~3190~~ 4630	185								35787	~~35,451~~

All fully dedicated labor, material, and equipment required to: Provide operation services during construction including, but not limited to, administrative, supervisory, and material support, first aid, light duty vehicles, sand, and aggregate, warehouse, underground systems, muck transfer, maintenance of underground equipment, and miscellaneous support.

Summary Account TR682FAF was modified to reflect reduction in administration tasks.

Summary Account	Title
TR682EA1	Usage of Nevada Test Site Equipment
TR682EA10	ESF BATCH PLANT INVENTORY
TR682EA11	Temporary Buildings
TR682EA2	Construction Fuel
TR682EA3	Surface Temporary Utilities
TR682EA4	Constructor (Kiewit/PB) Management
TR682EA6	Surface Muck Handling
TR682EA7	Janitorial and Miscellaneous Support
TR682EA8	Trash
TR682EA9	Power Usage
TR682EC1	General Support Equipment
TR682EC2	FY95 CAPITAL PROCUREMENT
TR682FA1	Surface Muck Handling
TR682FA2	Janitorial
TR682FA3	Trash & Refuse (NTS)
TR682FA4	Power Usage
TR682FA5	General Surface & Utility O&M
TR682FA7	Warehousing & Materials Handling
TR682FA8	Access Control and Transportation
TR682FA9	YMP and K/PB Equipment Maintenance
TR682FAA	Fuel and Fueling Services
TR682FAB	Third Party Equipment Rental
TR682FAC	Constructors Project Engineering
TR682FAD	Constructors Supervision
TR682FAF	Constructors Administration
TR682FAG	Constructors Bonds & Insurance
TR682FAH	K/PB Equipment Rental
TR682GA1	Janitorial
TR682GA2	Trash & Refuse (NTS)
TR682GA3	Power Usage
TR682GA4	General Surface & Utility OBM
TR682GA5	Warehousing & Materials Handling
TR682GA6	Access Control and Transportation
TR682GA7	YMP & KPB Equipment Manitenance
TR682GA8	YMP & K/PB Equipment Rental & Maintenance
TR682GA9	NTS Equipment Rental & Maintenance
TR682GAA	Constructors Project Engineering

ADD TR682FAK - VENTILATION TESTING & MONITORING
TR682FA1 - ECRB DIRECT SUPERVISION & ENGINEERING
TR682FAJ - LEASE CONSTRUCTORS EQUIP. FOR ECRB

TR682GAF ECRB MUCK HANDLING

NOTE: ECRB ACTIVITIES INCLUDE INDIRECT ELEMENTS THAT ARE FULLY DEDICATED TO THE CROSS DRIFT EXCAVATION. OTHER INDIRECTS WILL BE PART OF FY98 PLANNING.

TR682 Exploratory Studies Facility (ESF) Construction Op (continued)

Summary Account	Title
TR682GAB	Constructors Supervision
TR682GAC	Constructors Administration
TR682GAD	Constructors Bonds & Insurance

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date

Approvals

Robert M. Sandifer — Preparer - print name — 7/3/97 Date
JERRI J. ADAMS — Technical Reviewer - print name — 8/11/97 Date
R. D. HABBE — QA Reviewer - print name — 8-13-97 Date

Preparer - signature
Technical Reviewer - signature
QA Reviewer - signature

Prepared - 07/03/97:14:13:15 | Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.6.13 TR

P&S Account Title - Technical Support

WBS No. - 1.2.6.13

WBS Title - Technical Support

BASELINE Start Date - 10/01/95
BASELINE Finish Date - 09/30/98

Q AS NOTED VKD 8/7/97

Element ID - TR6D

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
					Fiscal Year Distribution								
Annual Budget	7128	~~8687~~	~~0~~	~~0~~	0	0	0	0	0	0	0	0	~~15815~~

Statement of Work: ~~8687~~ ~~8016~~ ~~814~~ 541 232 * BAD 8-1-97 16,588 ~~16,753~~ * BAD 8-1-97 BAD 7-8-97

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

QARD APPLIES TO THIS EFFORT.

All deliverables accepted in accordance with DOE procedure for acceptance reviews unless otherwise noted. Provide technical support for ESF Construction, Operations, and Testing by performing the following related tasks: Provide detailed planning and coordination of the underground testing program. Perform Title III services to the ESF construction program as defined by DOE Order 4700.1. control the Drawing, Specifications, and other technical documents that defines the ESF configuration. Provide ground support design confirmation as required by 10CFR60. Support the development and maintenance of the QA/QC Programs. Provide testing services for materials and calibration of equipment. Provide detailed planning and review of technical activities and products. Coordinate and provide technical services from agencies external to the YMSCO. Provide technical support and develop requirements for the ESF operations and maintenance program. Procedures are referenced in Grading Reports. Acceptance Criteria: Work will be measured through performance based audits and surveillances.

Summary Account TR6DFA6 scope reduced to reflect a reduction in supervision and support tasks.

o The VA enhancement CR added the documentation of ESF "Lessons Learned" during the Design & Construction of Main Loop. This information will be useful for the planning of the Repository Program. This scope was added to TR6DFA3.

Summary Account	Title
TR6DC0	FY1995 Carryover
TR6DEA01	ESF QA Training and Procedures
TR6DEA05	OBM Field Engineering Support
TR6DEA10	Calibration Services (Q) VKD 8/1/97
TR6DEA2	ESF Title III
TR6DEA3	ESF Ground Control Confirmation
TR6DEA4	Design Supervision
TR6DEA6	Testing Services
TR6DEA9	ESF Test Management and Operations
TR6DFA1	Test Coordination (FY97)
TR6DFA2	Title III Support for Construction (FY97)
TR6DFA3	Engineering Document Control

Prepared - 07/03/97:14:13:15 | Participant Planning Sheet (PSA03) | Inc. Dollars in Thousands

P&S Account No. - 1.2.6.13 TR -Technical Support

RMS 8-1-97 * $773K ($~~938K~~)

Statement of Work (cont.):

TR6DFA4	Material Testing Services
TR6DFA5	Equipment Calibration (Q) v/d 8/1/97
TR6DFA6	Design Supervision & Engineering Support
TR6DFA7	Records Coordination
TR6DFA8	Develop Punch List
TR6DFAA	ESF Procedures & Training
TR6DFAB	ESF Other Design Support (FY97)
TR6DFAB1	Support Systems Baselines Development
TR6DFAD	Lessons Learned in the ESF
TR6DFAF	Constructor's Non Q Quality Control
TR6DFB1	AE System Transition Reports
TR6DFB2	Ground Support Conformation (FY97)
TR6DGA1	Test Coordination (FY98)
TR6DGA2	Title III Support for Construction (FY98)
TR6DGA3	Material Testing Services
TR6DGA4	Design Supervision & Engineering Support
TR6DGA6	Engineering Document Control (FY98)
TR6DGA9	Develop Punchlists
TR6DGAA	TT & Oper Monitor
TR6DGAB1	Develop Systems Baselines
TR6DGAC	Ground Support Conformation (FY98)
TR6DGAD	Equipment Calibration
TR6DGAE	ESF Management & Coordination (FY98)
TR6DGB1	Construct ESF Monitoring Systems

ADD TR6DGA2B - ECRB TITLE III -($~~938K~~)

NOTE: ECRB TITLE III ACTIVITIES INCLUDES FULLY DEDICATED SUPPORT FOR CROSS-DRIFT EXCAVATION. OTHER TITLE III ACTIVITIES WILL BE INCLUDED IN FY98 PLANNING

X RMS 7-8-97

DELIVERABLES

Deliv ID	Description/Completion criteria	Due Date
SC6340M3	ESF Lessons Learned Report Criteria - This report will summarize the problems encountered in the design and construction of the ESF five mile loop that resulted in "Lessons Learned" that have potential applicability for future project activities. This integrated report will consider all of the functions that were necessary to perform the ESF task. This Deliverable will be submitted to DOE in accordance with YAP5.1Q, and will be considered completed when logged into the TPM database.	01-Sep-97

Participant PPMSM097	Yucca Mtn. Site Char. Project-Planning & Control System	01-Jun-97 to 30-Jun-97
	PACS Participant Work Station (PPWS)	Page - 3
Prepared - 07/03/97:14:13:15	Participant Planning Sheet (PSA03)	Inc. Dollars in Thousands

P&S Account No. - 1.2.6.13 TR -Technical Support

Approvals

Robert M. Sandifer 7/3/97	JERRI J. ADAMS 7/11/97	R.D. HABBE 8-13-97
Preparer - print name Date	Technical Reviewer - print name Date	QA Reviewer - print name Date
Preparer - Signature	Technical Reviewer - Signature	QA Reviewer - Signature Date

Inc. Dollars in Thousands (Esc.)

P&S Account - 1.2.8.4.2 M&O

P&S Account Title - Air Quality/Meteorology

PWBS Element Number - 1.2.8.4.2

PWBS Element Title - Air Quality/Meteorology

Baseline Start - 01-oct-1996
Baseline Finish - 30-sep-1998

7/8/97 for DKC 7/8/97 for DKC

1368 MK 231 MK

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
		Fiscal Year Distribution											
Annual Budget	0	1337	0	0	0	0	0	0	0	0	0	0	1337

Statement of Work

The following work shall be controlled in accordance with approved implementing procedures identified on the current OCRWM-accepted Requirements Traceability Network Matrix.

QARD APPLIES TO THIS EFFORT

Maintain Meteorological Study Plan and associated technical implementing plans and procedures. Maintain Environmental Field Activity Plan for air quality and associated technical implementing procedures. Operate, maintain, process and report data from nine meteorological monitoring stations. Operate, maintain, process and report data from four particulate matter air quality monitoring stations. Report required results to Nevada Division of Environmental Protection to fulfill air quality permit stipulations and accumulate irretrievable data for use in site characterization. Operate, maintain, process and report data from an extensive precipitation measuring network in support of USGS infiltration studies. Provide for the calibration and analysis of particulate matter air quality samples taken within the underground ESF and enhanced characterization of the repository block. MK for DKC 7/8/97
NOTE: Accumulation of regional data is not included in this scope of work.

All deliverables will be accepted in accordance with DOE procedures for acceptance review, unless otherwise noted.

Summary Account	Title
TR842FA1	Air Quality/Meteorology
TR842GA1	Air Quality/Meteorology

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
SS3003	Issue Ambient Air Quality Report Criteria - Deliverables will be satisfied by reporting Ambient Air Quality Monitoring data to the YMSCO/AMESH for submittal to the State of Nevada as required by issued Air Quality Permits. This activity currently requires reporting specific air quality and meteorological data to the State within 60 days after the end of each calendar quarter. This deliverable is considered non-quality affecting in accordance with established criteria of the OCRWM QARD.	19-nov-1996
SS3009	Issue Ambient Air Quality Report Criteria - Deliverables will be satisfied by reporting Ambient Air Quality Monitoring data to the YMSCO/AMESH for submittal to the State of Nevada as required by issued Air Quality Permits. This activity currently requires reporting specific air quality and meteorological data to the State within 60 days after the end of each calendar quarter. This deliverable is considered non-quality affecting in accordance with established criteria of the OCRWM QARD.	18-feb-1997

Inc. Dollars in Thousands (Esc.)

TR842 Air Quality/Meteorology (continued)

DELIVERABLES

Deliv ID	Description/Completion Criteria	Due Date
SS3015	Issue Ambient Air Quality Report Criteria - Deliverables will be satisfied by reporting Ambient Air Quality Monitoring data to the YMSCO/AMESH for submittal to the State of Nevada as required by issued Air Quality Permits. This activity currently requires reporting specific air quality and meteorological data to the State within 60 days after the end of each calendar quarter. This deliverable is considered non-quality affecting in accordance with established criteria of the OCRWM QARD.	20-may-1997
SS3021	Issue Ambient Air Quality Report Criteria - Deliverables will be satisfied by reporting Ambient Air Quality Monitoring data to the YMSCO/AMESH for submittal to the State of Nevada as required by issued Air Quality Permits. This activity currently requires reporting specific air quality and meteorological data to the State within 60 days after the end of each calendar quarter. This deliverable is considered non-quality affecting in accordance with established criteria of the OCRWM QARD.	19-aug-1997

Approvals

D.K. Chandler 7/8/97 — R.D. HABBE 8-13-97

D.K. Chandler 9/25/97 — Wendy Dixon 9/25/97 — Richard A. Kettell 9/26/97

Preparer - print name — Date — Technical Reviewer - print name — Date — QA Reviewer - print name

for D.K. Chandler — Technical Reviewer - signature — Richard A. Kettell

Preparer - signature — QA Reviewer - signature

Michael W. Harris 7/8/97 — R.D. Habbe

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

MAR 2 5 1997

L. D. Foust, Technical Project Officer
for Yucca Mountain Site
Characterization Project
TRW Environmental Safety Systems, Inc.
1180 Town Center Drive, M/S 423
Las Vegas, NV 89134

ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

Pursuant to the work scope in Work Breakdown Structure 1.2, the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) is responsible for planning and scheduling project activities.

Pursuant to our discussion in early March, the CRWMS M&O is directed to initiate planning and scheduling activities to implement a program for enhanced characterization of the repository block through incorporation of a new drift in Exploratory Studies Facility. The resulting plan shall describe work that will enhance understanding of the scientific, health and safety, engineering, construction, and cost aspects of the repository.

CRWMS M&O shall interface with the U.S. Department of Energy and other affected parties to ensure that appropriate requirements and options are identified and evaluated. The plan must address the relationship between ongoing site characterization activities and the enhanced characterization. In addition, the plan must integrate the drift into the proposed configuration of a future repository. However, the new planning efforts shall not adversely impact design activities for the Viability Assessment.

Please keep me advised of the baseline changes that will be required to implement this planning activity. All planning and scheduling documentation shall accompany the change request for submission to the Level Two Change Control Board.

The change request for the Enhanced Characterization of the Repository Block shall be completed as soon as possible, but no later than June 3, 1997.

Jerri J. Adams
Contracting Officer Representative

AMAAM:MWS-1223

cc:
Douglas Baptist, DOE/HQ (HR-561.21) FORS
B. V. Hamilton-Ray, DOE/YMSCO, Las Vegas, NV
J. M. Replogle, DOE/YMSCO, Las Vegas, NV
Records Processing Center = "4"

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR12GB7
2. Summary Account Title: Requirements and Con-Ops Updates to Support ECRB
3. Summary Account MGR/ORG: Sam Rindskopf/MGDS Requirements and Integration/Configuration Management

4. Status of Change: ____ Revised ___X New

5. Scope Description:

Provide the following support for ECRB activities:

1. Develop ECRB Inputs to Maintain the ESFDR (10/1/97 - 9/30/98):

Develop inputs to the ESFDR to capture necessary updates resulting from continued evolution and design of ECRB. Two inputs are assumed to be required in FY98.

The weighted milestone approach of calculating earned value is used for this activity.

The milestones for this account are:

1. ECRB inputs to ESFDR, ICN 1	20%
2. ECRB inputs to ESFDR, ICN 2	20%

2. Develop ECRB Inputs to Update ESF Concept of Operations (Con-Ops) (10/1/97 - 9/30/98):

Develop ECRB inputs to complete the ESF Con-Ops update initiated in FY97. Coordinate with the Title III Con-Ops. Draft ECRB inputs to update the ESF Con-Ops to be completed by mid-FY98. Revised draft ECRB inputs to update the ESF Con-Ops at the end of FY98 will include additional ECRB activity.

The weighted milestone approach of calculating earned value is used for this activity.

The milestones for this account are:

1. Draft ECRB inputs to ESF Con-Ops	30%
2. Revised draft ECRB inputs to ESF Con-Ops	30%

6. Scope Differences from the Baseline:

New work.

7. Key Assumptions:

A. ESFDR will govern the requirements underpinning the ECRB.

B. The early start focus is an ICN to the ESFDR.

C. The ESF Con-Ops update initiated in FY97 will be completed in FY98.

D. Updates to the ESF Con-Ops outside the scope of ECRB are adequately funded in the FY98 baseline.

E. The Surface Based Testing Facilities Requirements Document (SBTFRD) does not require an update to support ECRB.

F. The FY97 ICN to the ESFDR is successful in capturing the major set of requirements for ECRB.

G. Updates to the ESFDR outside the scope of ECRB are adequately funded in the FY98 baseline.

8. Cost Rationale:

The period of conduct of activities for the purposes of this estimate is assumed to be 10/1/97 through 9/30/98.

Rationale by task description (see Section 5 for task descriptions):

1. This task is to develop ECRB inputs to maintain the ESFDR. Each of the two ECRB inputs will require 1.5 man-months, for a total of 3 man-months. In addition, each ECRB input will require 0.15 man-months of management support and 0.5 man-months of administrative assistant support.

TRW 101A 0.3 MM
TRW 101B 3.0 MM
TRW 103 1.0 MM

2. This task is to develop ECRB inputs to complete the ESF Con-Ops initiated in FY97. A draft input and a revised draft input will be provided in FY98. Each input will require 2 man-months for a total of 4 man-months. The total management support required will be 0.4 man-months and the total administrative assistant support will be 1.0 man-months.

TRW 101A 0.4 MM

TRW 101B 4.0 MM
TRW 103 1.0 MM

Total estimated cost based on above estimate: See PPS

9. Level III Milestones:

No Level 3 milestones have been identified.

10. Level III Milestone Acceptance Criteria:

Not applicable.

11. Attachments and References:

None.

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR142FA4
2. Summary Account Title: System Engineering & Integration Support for the Enhanced Characterization of the Repository Block (ECRB) - Phase I (Early Start)
3. Summary Account MGR/ORG: Sam Rindskopf/MGDS Requirements and Integration/Configuration Management

4. Status of Change: ___ Revised ___X New

5. Scope Description:

   Provide the following support for ECRB activities:

   Management, Planning, and Integration (10/1/97 - 12/31/98):

   Provide management, planning, and integration to support ECRB. This includes the overall management, planning, and integration for Systems Engineering activities pertaining to ECRB.

6. Scope Differences from the Baseline:

   New work.

7. Key Assumptions:

   A. This work scope assumes that all financial tracking, status reports, and technical integration is captured in WBS 1.2.1.4.2 and not in other WBS areas in Systems Engineering.

   B. This work scope assumes that integration with ECRB activities related to performance confirmation tasks needs to be conducted in conjunction with the ECRB activity

8. Cost Rationale:

   The period of conduct of activities for the purposes of this estimate is assumed to be 10/1/97 through 12/31/98.

   Rationale by task description (see Section 5 for task descriptions):

The management, planning, and integration to support ECRB will require 0.25 FTE/month over the 15 month duration of this activity.

TRW 101A 1.8MM
TRW 101B 2.0MM

Total estimated cost based on above estimate: See PPS

9. Level III Milestones:

No Level 3 milestones have been identified.

10. Level III Milestone Acceptance Criteria:

Not applicable.

11. Attachments and References:

None.

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR16GB3
2. Summary Account Title: Development of ESF-MGDS ICD to Support ECRB
3. Summary Account MGR/ORG: Sam Rindskopf/MGDS Requirements and Integration/Configuration Management

4. Status of Change: ____ Revised ___X New

5. Scope Description:

Provide the following support for ECRB activities:

Complete the ESF-MGDS Interface Control Document (ICD) (8/1/97 - 10/31/97):

Complete the ESF-MGDS ICD initiated as part of the ECRB early-start activities with ICD, Revision 0, on 10/31/97. This will include further evaluation of interface requirements by an Integrated Product Team (IPT), expansion of definition of interfaces that were developed in the early-start activities, review and consideration of interface issues that have been identified since early-start activities, detailed ICD preparation, and ICD review and approval. ICD review and approval will consist of the conduct of the review, collection, resolution, and incorporation of review comments, and the submittal of the document and associated records to the appropriate organizations. Level 3 deliverable: ESF-MGDS ICD, Revision 0. The interface captured by the ESF-MGDS ICD is a Level C interface. As a Level C interface, ultimate approval and control of the ICD will be administered by the M&O Level III Change Control Board, consisting, as a minimum, of the MGDS Systems Engineering/Integration Office Manager, MGDS Development Manager, Engineering & Integration Operations Manager, MGDS Project Engineering Manager, Regulatory Operations Manager, Site Evaluation Program Manager, and Configuration Management Manager.

The weighted milestone approach of calculating earned value is used for this activity.

The milestones for this account are:

1. Review draft of ICD	60%
2. Final review draft of ICD	20%
3. Completed ICD, Revision 0	20%

6. Scope Differences from the Baseline:

New work.

7. Key Assumptions:

A. ESFDR will govern the requirements underpinning the ECRB, including interface requirements.

B. The early start ICD activities are completed as planned.

C. The ESFDR ICN that incorporates interface requirements for the ECRB is completed as planned.

D. The FY97 ICN to the ESFDR is successful in capturing the major set of requirements for ECRB.

8. Cost Rationale:

The period of conduct of activities for the purposes of this estimate is assumed to be 8/1/97 through 10/31/97.

Rationale by task description (see Section 5 for task descriptions):

Twenty person-days of Integrated Product Team (IPT) support (assume five IPT members for four days each) for evaluation of ICD requirements; ten person-days of IPT support for the identification of interfaces; six person-weeks of Systems Integration and Subsurface Design resource (split one-third TRW 101B and two-thirds MK 101B) for ICD preparation including CAD support; two person-weeks of Requirements resource (TRW 101B) for review & approval coordination; and five person-weeks of IPT support (five IPT members for one week each) for ICD review.

TRW 101B	2.1 MM
FD 101B	0.6 MM
MK 101B	2.1 MM

Total estimated cost based on above estimate: See PPS

9. Level III Milestones:

See attachment.

10. Level III Milestone Acceptance Criteria:

See attachment.

11. Attachments and References:

Level III Milestone.

Preliminary FY98 APS

Deliverable

PS No: TR16
Summary Acct: TR16GB3 VA Activity: Yes
Summary Acct Title: Development of ESF-MGDS ICD to Support ECRB
PSS ID: SE125A
Baseline Start: 08/01/97 Baseline Finished: 02/31/98
Type: Discrete
CWBS: 1.2.1.6
Functional MGR Name: RINDSKOPF M.

Deliverable

Deliverable Title: ESF-MGDS ICD Revision 0
Deliverable Acceptance Criteria: The interface control document will be a M&O document prepared according to the appropriate QA procedures and it will define the critical parameters of the interface between the design of the ESF, including ECRB design interfaces, and the MGDS, including, but not limited to interfaces between the underground design of the ESF layout and the repository areas, and interfaces between permanent ESF/ECRB features, and the MGDS. The deliverable is complete upon submittal of an M&O approved document to YMSCO.
Deliverable ID: SE171M3
Deliverable Due Date: 10/31/97
Milestone Level: 3rd
Work Package ID:
Relative Weight:

This Deliverable has been updated by: Mark Sellers
Last Updated By: Mark Sellers Last Update: 03/31/97 07:39:08 AM

BASIS OF ESTIMATE
FOR THE ESF CHANGE REQUEST TO IMPLEMENT THE ECRB

1. Summary Account Number: TR18GA3

2. Summary Account Title: Safety Assurance Specialty Engineering Support for Enhanced Characterization of the Repository Block (ECRB) - Phase II

3. Summary Account MGR/ORG: Peter Hastings/MGDS Safety Assurance

4. Status of Change: ___ Revised _X_ New

5. Scope Description:

   A. Provide LOE Specialty Engineering support for Exploratory Studies Facility (ESF) ECRB underground excavation designs, testing activities, and other ESF maintenance and operational activities.

      1. Evaluation of ECRB excavations or other significant designs or design changes for system safety impacts and preparation of system safety analyses (SSAs) or revisions, as necessary, comparing new design drawings to existing SSAs.

6. Scope Differences from the Baseline:

   New work - ECRB phase I work complete.

7. Key Assumptions:

   A. The account is limited to the resources necessary to perform the assigned tasks that are in addition to the current management, technical, and administrative staff resources funded by the FY98 baseline.

   B. This estimate assumes funding approval and completion of ECRB Phase I (early start).

   C. This estimate assumes work scope to commence October 1, 1997 and completes September 30, 1998, and does not include planning for Calico Hills excavation.

   D. This estimate assumes this effort applies to the ECRB only and consists of analyses on new designs or changes, and that necessary changes/revisions to existing SSAs (or new SSAs) will be made without consolidation of existing SSAs.

E. This estimate assumes that designs or tests requiring Reliability, Availability, and Maintainability (RAM) and Human Factors (HFE) analyses are not planned; therefore, separate discrete RAM and HFE analyses will not be required. RAM and HFE will only be tasked to support the development of the SSAs as required.

F. The YMP Safety and Health Plan (YMP/90-37) discusses SSAs, JSAs, and "Safety Analyses." This estimate assumes that the term "Safety Analysis" does not mean a separate analysis, but instead refers to the combination of SSAs and JSAs, which, as an integral package, evaluate the sum total of the design and construction facilities. No separate report or analysis - apart from SSAs and JSAs - will be produced.

G. The M&O shares with DOE the responsibility for the establishment and maintenance of a safe working environment in the ESF. The M&O proposes to use the ECRB exercise to evolve and enhance our safety and health program through effective implementation of plans and procedures. This evolution will be a fairly low-cost, non-critical-path effort that will nevertheless result in increased confidence on the part of M&O and DOE management in the establishment of a safe working environment. SSAs will be performed on construction, operations, and maintenance designs; JSAs will be developed for those processes and procedures having a personnel safety impact; the production of these processes will be integrated between the Systems Engineering Safety Assurance department and the Construction Management Office to ensure that designs and construction and operational environments are appropriately evaluated. Further, integration between SSAs and JSAs will be coordinated through collateral reviews to ensure consistency - without redundancy - between SSAs and JSAs.

H. The following will be accomplished under FY98 ESF and MGDS Specialty Engineering support work packages:
   - tracking and documenting the implementation of mitigation features
   - collateral reviews of SSAs and JSAs to ensure consistency - without redundancy - between SSAs and JSAs.
   - maintenance of affected existing SSAs
   - conduct of periodic (based on M&O and DOE guidance) reviews/assessments of effectiveness of improved safety analysis and implementation processes including feedback to M&O and DOE management on additional measures in support of repository process planning.

8. Cost Rationale:

The period of conduct of activities for the purposes of this estimate, and in accordance with assumption 7.C above, is assumed to be October 1, 1997 through September 30, 1998.

Support is estimated at six person-months (approx. 2.5 man-months DE&S 101B, 3.5 man-months TRW 101B), based on historical required support for ESF activities.

9. Level III Milestones:

For these activities, no Level 3 milestones have been identified.

10. Level III Milestone Acceptance Criteria:

Not applicable.

11. Attachments and References:

None.

PPS Input

The following tasking is specific to ECRB support: Provide LOE Specialty Engineering support for ESF ECRB underground excavation designs, testing activities, and other ESF maintenance and operational activities. Perform evaluation of ECRB excavations or other significant designs or design changes for system safety impacts and preparation of analyses or revisions to existing ESF system safety analyses (SSAs) as necessary comparing existing SSAs to new design drawings.

BASIS OF ESTIMATE
FOR THE ESF CHANGE REQUEST TO IMPLEMENT THE ECRB

1. Summary Account Number: TR1BGB3

2. Summary Account Title: Safety Assurance DIE Support for Enhanced Characterization of the Repository Block (ECRB) - Phase II (Including SBT Activities)

3. Summary Account MGR/ORG: Peter Hastings/MGDS Safety Assurance

4. Status of Change: ____ Revised _X_ New

5. Scope Description:

A. Provide the following support for development of ECRB Subsurface Excavation:

1. Determination of Importance Evaluations (DIEs) including revisions and associated waste isolation impact analysis; Tracers, Fluids, and Materials (TFM) evaluation; and test interference analysis: develop subsurface DIE(s) including required revisions and associated input to and review of ECRB Planned Design, Testing, and Construction Activities;

2. Revisions to ESF Classification Analyses (CAs) to address ECRB requirements regarding permanent repository items;

3. Evaluate TBM special requirement implementation prior to start of excavation of the main drift of the ECRB; and

4. Evaluate implementation of DIE and CA requirements through site visits and reviews of drawings, specifications, job and field work packages, underground field testing activities, work programs, TFM submittals, constructor submittals to A/E, and participation as a member of active Configuration Control Board as required.

B. Provide the following support for ECRB Surface-Based Testing (SBT) Activities:

1. Develop DIE(s) including required revisions and associated input to and review of ECRB SBT for South Crest and Northern Teacup Wash Boreholes including associated design, testing, operation, and construction activities; and

2. Evaluate implementation of DIE(s) requirements through site visits and reviews of drawings, specifications, job and field work packages, field testing activities, TFM submittals, constructor submittals to A/E, and work programs as required.

6. Scope Differences from the Baseline:

New work - ECRB phase I work complete.

7. Key Assumptions:

A. The account is limited to the resources necessary to perform the assigned tasks that are in addition to the current management, technical, and administrative staff resources funded by the FY98 baseline.

B. This estimate assumes funding approval and completion of ECRB Phase I (early start).

C. This estimate assumes work scope to commence October 1, 1997 and completes September 30, 1998, and does not include planning for Calico Hills excavation.

D. This estimate assumes that funding for organizations participating in reviews of DIEs, etc. (e.g., PA and SPO support) is described in other Statements of Work.

8. Cost Rationale:

The period of conduct of activities for the purposes of this estimate, and in accordance with assumption 7.C above, is assumed to be October 1, 1997 through September 30, 1998.

Rationale by task description (see Section 5 for task descriptions):

A. Six months of one full-time DIE resource (DE&S 101B) to integrate DIE-related and waste isolation/SPO issues, prepare subsurface DIE(s) and CA(s), review documents for implementation.

One month of support for discipline reviewer of DIEs (DE&S 101B)

One month of support for Lead Design Engineer (LDE) (FD 101B)

B. Three and one-half months of one full-time DIE resource (DE&S 101B) to integrate DIE-related and waste isolation/SPO issues, prepare SBT DIEs, and review documents for implementation.

Three man-weeks of support for discipline reviewer of DIEs (DE&S 101B)

One month of support for Lead Design Engineer (LDE) (FD 101B)

Total estimated cost based on above estimate: TBD

9. Level III Milestones:

For the DIE ECRB activities, no Level 3 milestones have been identified.

10. Level III Milestone Acceptance Criteria:

Not applicable.

11. Attachments and References:

None.

PPS Input

The following tasking is specific to ECRB support: Provide discrete DIE support for Exploratory Studies Facility (ESF) ECRB underground excavation and Surface-Based Testing (SBT) activities, including DIE preparation and revisions; Tracers, Fluids, and Materials (TFM) evaluation; revisions to ESF Classification Analyses (CAs) to address ECRB requirements regarding permanent repository items; evaluation of TBM special requirement implementation prior to start of excavation of the main drift of the ECRB; and evaluation of implementation of DIE and CA requirements through site visits and reviews of drawings, specifications, job and field work packages, underground field testing activities, work programs, TFM submittals, constructor submittals to A/E, and participation as a member of active Configuration Control Board as required.

Testing Working Group Overview (WBS 1.2.3)

The testing working group met several times to identify testing objectives for enhanced characterization of the repository block and testing configurations that would be best suited to meeting those objectives. The testing working group initially identified 26 testing objectives. These were modified and combined with testing objectives identified by the other working groups of the enhanced characterization effort. During discussions of the entire list of testing objectives a number of key points were identifed repeatedly.

1> It is important to have hydrologic testing and sampling for environmental isotopes and fracture filling minerals below the zone of high surface infiltration defined by Alan Flint. Reason- this is the area where we potentially have the best input signal for our measurements, even over long time frames.

2> Displacement on the Solitario Canyon fault increases dramatically from north to south. We need to study the fault at a location where the displacement is great enough to see well developed physical characteristics of the fault zone itself and wall rock deformation associated with the fault. We also need enough displacement to allow us to access the Calico Hills without traversing the vitrophyre.

3> We have very little data on the physical properties of the rocks in the actual emplacement horizon itself. It is important to traverse as much of this horizon as possible. This point has several subpoints. The lower lithophysal zone of the Topopah will constitute at least 50% of the repository horizon and we have only limited data on this unit, from limited exposures in the ESF that traverse the very upper most portion of the unit and limited borehole data. Hydrologic properties of this unit will be particularly important and could be significantly different from what we have seen in other units. This potential difference results from the observation that fracture characteristics, such as continuity, curvature, abundance, etc., are strongly influenced by the presence and abundance of lithopysae. The distribution and abundance of lithophysae in this unit could be significantly different in this unit from other units that we have encountered higher in the section. This means that it is critical to do tests like the niche studies in the lower lith under the areas of high surface infiltration. Otherwise we will always be accused of trying to biase our results.

4> Fracture distributions and abundances very both from north to south and within the section between stratigraphic subunits. In part this is a subset of point 3 and makes it important to sample the entire section of the emplacement horizon if possible. This also indicates that it is important to study the Solitario Canyon fault where it crosses the emplacement horizon because the wallrock deformation may change significantly between stratigraphic subunits.

5> Testing in the Calico hills would improve our understanding of flow and transport processes below the repository horizon. The configuration that we have suggested would allow us to sample for environmental isotopes and other data to characterize flow and transport and to field an in-situ test to study flow and transport processes.

6> The splay coming off of the Solitario Canyon fault in the central part of the block shows decreasing displacement going upsection in outcrop. One interpretation of this data is that it is a pre-Tiva fault. If this is correct it could rpoject for significant distances into the potential repository block. This possibility should be checked by underground construction.

The working group reviewed a number of options for collecting data that would address these key points and meet the testing objectives of all of the working groups. The options included a variety of surface-based boreholes and underground configurations.

Surface Based Testing considered:

Crest boreholes north and south of SD-6
Slant borehole in northern Solitario Canyon
Southern Testing Complex
Pair of WT-boreholes - central part of the Solitario Canyon Fault

Underground Configurations considered:

East-west across northern part of the block
East-west across central part of the block
East-west across southern part of the block
Above-within-below the emplacement horizon
(a total of nine combinations were considered)
All of the above combinations with a Calico Hills access added

Continued discussion and evaluation has led to a proposed testing configuration that is modified from the initial considerations. Two boreholes are included, one on the crest of Yucca Mountain south of SD-6 and one to the north of SD-6 in Teacup wash. The northern crest borehole was moved to Teacup wash in order to provide better information for repository design on potential expansion of the repository block to the north.

A modified underground configuration is being proposed that starts off of the north ramp and traverses southwest across the block and intersects the western boundary of the repository block north of SD-6. The cross drift will be approximately 15 meters above the proposed emplacement horizon. The cross drift will terminate east of the Solitario Canyon Fault and a borehole will be completed across the fault. Testing will be conducted in this borehole for approximately four months and then construction across the fault will be completed. Construction to the Calico Hills formation could be continued in FY99. This configuration was initially developed as a compromise between the testing and design/construction working groups. As planning has continued it has become clear that this configuration is probably better, from a testing point of view, than any of the configurations initially considered by the testing group. The underground workings will include two alcoves and two niches, to be constructed in FY 98. One alcove will be constructed where the new drift crosses over the existing north-south main of the ESF. This alcove is planned to be above one of the niches to be constructed in the current ESF. A second

alcove will be constructed under the crest of Yucca Mountain to provide the opportunity to conduct hydrologic tests under the zone of high surface infilitration. One niche will be constructed in the lower lithophysal zone of the Topopah Springs and the other will be constructed in the lower nonlithophysal zone, to conduct hydrologic tests in these units. A third alcove, to be constructed in FY 99, will be designed to test the Solitario Canyon Fault.

The proposed configuration is considered optimum because it address each of the six key points raised by the testing working group. First, it will provide access to areas below the zone of high surface infilitration. As a bonus it will also provide us with the opportunity to evaluate the effects of variations in the surface boundary condition because the drift will cross under zones of high and low surface infiltration. Second the cross drift will intersect the Solitario Canyon Fault where the displacement and complexity of faulting should be optimum for study. Third the cross drift will go through all of the subunits that are included in the potential emplacement horizon. Fourth the cross drift will provide a good opportunity to observe variations from north to south of fracture characteristics. Fifth the configuration will allow us to access the Calico Hills formation in FY 99. Sixth the splay of the Solitario Canyon Fault can be studied from the cross drift location.

The enhanced characterization of the repository block (ECRB) requires a cross drift to extend beyond the current ESF level to reach deeper repository host units and the western fault boundary of the repository block. With ESF experience, the cross drift can be regarded in part as the first performance confirmation drift and in part as an integrated testing and monitoring drift to reduce key remaining uncertainties in unsaturated zone conditions, thus building higher confidence in establishing credible predictive models for TSPA-LA. Both (a) confirmation tasks and (b) tests to meet technical challenge for supporting performance assessment and repository design are planned for the ECRB. Some of these tasks are included in this Change Request and some of them will be included in the FY 98 planning exercise.

The cross drift confirmation tasks can enhance our understanding of the Yucca Mountain site by (a1) thoroughly monitoring construction water usage and ventilation impacts on the drift conditions and on the drying of tunnel walls, (a2) mapping fracture distributions and fault correlation with surface-based mapped traces, (a3) collecting samples for environmental tracer and fracture filling distributions associated with potential fast and preferential pathways, and (a4) characterizing fault properties of the Solitario Canyon Fault and any other faults intercepted by the E-W drift.

The cross drift can be an integrated testing facility to reduce uncertainties in the understanding for UZ flow and transport processes of (b1) seepage into drifts in lower lithophysal and non-lithophysal units; (b2) migration of water and tracer from the drift inverts to deeper units; (b3) interactions and partition between fracture flow and matrix flow; and (b4) percolation of water at the repository horizon in different rock host rock units below surface infiltration zones. Where the cross drift is excavated above the existing ESF Main (b5) drift-to-drift tests are planned.

The cross drift offers the opportunity to conduct integrated tests with close cooperation among scientific investigation, performance assessment, and repository design. The construction impact

evaluation of water usage and dust suppression (a1) and the tracer migration (b2) tasks will use data collected by both scientific organizations and the ESF Constructor. Mapping and sample collection tasks along the drift (a2 and a3) and in the fault (a4) will develop optimal coordination with TBM excavation and drilling operations. Alcoves planned along the cross drift will address key performance assessment and waste isolation concerns about seepage into drifts (b1), tracer migration (b2 and b5), fracture-matrix interactions (b3), and percolation flux in the repository horizon (b4) in lower lithophysal and lower non-lithophysal units not exposed in the ESF Main Drift. Niches to be planned during the FY 98 planning effort will also address these issues. Many on-going monitoring, mapping, sampling and testing tasks in (a) and new initiatives of niche seepage testing, tracer migration, fracture-matrix interaction, and percolation flux quantification in (b) planned in the ESF and in the cross drift can enhance and provide key data needed to reduce uncertainties in the process models that will serve as the basis for TSPA-LA.

Assumptions WBS 1.2.3

Testing during the construction phase was prioritized to emphasize prediction, model confirmation and collection of irretrievable data and early results that can support VA.

The cross drift will be designed to avoid interference with the drift scale thermal test.

2 m rib boreholes and 5-10 m boreholes in the invert will be drilled at regular intervals during TBM construction for hydrologic testing.

All testing will be planned and coordinated through the SPO.

Funding included in the CR does not include the incremental increase in QA support activities that will be required by this work.

Construction of the starter tunnel for the TBM will begin in Oct/Nov 97.

Construction to provide access to the Calico Hills formation will occur in FY 99.

Sampling, geologic mapping, and moisture monitoring for hydrology will be conducted as the TBM advances.

Construction of the cross drift will begin from the North Ramp.

The cross drift will cross above the north south main at 3581.

The cross drift will intersect the Solitario Canyon Fault approximately due west of SD 12.

The cross drift will be mapped in a one-pass operation, with exposed drift cleaned with an air/water blowpipe prior to mapping.

Construction planning and utility configurations will maximize the continuous percentage of the periphery left unobstructed for mapping.

There will be an independent platform for photography, mapping and sampling.

There will be continuous access to standard electricity and outside phone lines.

The main testing in the cross drift and associated alcoves will begin in FY 99.

Predictive analyses will include all SPO areas, design/construction will predict constructibility.

BASIS OF ESTIMATE
FOR THE INITIAL ACTIVITIES OF THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR32111FB2

2. Summary Account Title: Mineralogic Support of Drilling of SBT Boreholes

3. Summary Account MGR/ORG: Dixon/SPO-LANL

4. Status of Change: _X_ Revised ___ New

5. Scope Description:

This summary account will provide close to real-time erionite analyses of samples obtained during drilling of SD-11 and SD-13. The impacts of not analyzing samples during drilling are great, as the potential exists to encounter rocks containing significant amounts of erionite. The effort will concentrate on analysis for hazardous minerals, focusing on erionite in those intervals where it may occur. In addition, this summary account will provide a detailed prognosis of the likely distribution of erionite in both drill holes before they are drilled. This prognosis will be based on the 3-Dimensional Mineralogic Model of Yucca Mountain and will rely significantly on known zeolite distributions in nearby drill holes.

The prognoses and the real-time tracking will be conducted in FY'98 and FY'99, before and during the drilling of the boreholes. The prognoses will be presented in a level 4 report produced under TR39BFB1G.

Activities for FY97: N/A

Level 4 Deliverables:

Title: Real-time mineralogical analysis for erionite in drill hole SD-11
Deliverable No: ·
Due Date:Due Date: March 6, 1998
Acceptance Criteria: A letter report will be prepared and submitted to the M&O SPO office, and will be considered complete upon the acceptance of the product by the SPO technical lead for geochemistry. The report will contain quantitative X-ray diffraction analyses for erionite of core and cuttings samples obtained in almost real time during drilling of suspect zones in SD-6. Any identified occurrences of erionite will be communicated immediately by FAX and telephone to the office in charge of drilling in order to expedite the application of appropriate sample-handling measures. The final report will outline the distribution of erionite in the drill hole. Should drilling of

WT-24 extend beyond the end of FY'97, final analyses and the final report for WT-24 will be prepared.

Title: Real-time mineralogical analysis for erionite in drill hole SD-13
Deliverable No: New
Due Date: December 1, 1998
Acceptance Criteria: A letter report will be prepared and submitted to the M&O SPO office, and will be considered complete upon the acceptance of the product by the SPO technical lead for geochemistry. The report will contain quantitative X-ray diffraction analyses for erionite of core and cuttings samples obtained in almost real time during drilling of suspect zones. Any identified occurrences of erionite will be communicated immediately by FAX and telephone to the office in charge of drilling in order to expedite the application of appropriate sample-handling measures. The final report will outline the distribution of erionite in the drill hole.

6. Scope Differences from the Baseline: New Scope is being added to SA proposed for SD-6/WT-24 C/SCR. A title change for the summary account is also proposed with this C/SCR.

7. Key Assumptions:

Drilling of SD-11 will occur in FY'98 and drilling of SD-13 will begin in January, 1999. It is assumed that the SMF staff will be maintained to supply the support needed.

8. Cost Rationale:

FY'97 component of costs: none
FY'98 component of costs - $56K with PM&I ($53K LANL only)
FY'99 component of costs - $58K with PM&I ($55K LANL only)

Total FTEs:
0.24 FTE of staff mineralogist, Labor Category 101A
0.2 FTE of technician, Labor Category 101C

Total Travel:
2 trips to SMF to coordinate sample handling.

1) Real-time mineralogical analysis for erionite in both drill holes

Total labor hours to complete this task are:

0.1 FTE staff mineralogist (TSM, 180 hours), labor category 101A
0.2 FTE technician (TEC exempt, 350 hours), labor category 101C

Two trips to SMF to coordinate sample handling.

No procurements anticipated.

2) Hazardous-Mineral Predictions for both drill holes

Total labor hours to complete this task are:

0.14 FTE staff mineralogist (TSM, 250 hours), labor category 101A

No procurements anticipated.
No travel is anticipated.

9. Level III Milestones: None.

10. Level III Milestone Acceptance Criteria: N/A

11. Attachments and References: N/A

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR32111FB6

2. Summary Account Title: Analysis of Hazardous Minerals from the ESF to Facilitate Repository Testing, Design, Construction, and Operation

3. Summary Account MGR/ORG:

4. Status of Change: Revised _X_ New

5. Scope Description:

This summary account will address two problems in past site characterization that should be addressed prior to the development of documents needed for License Application:

a) There is a need to provide quantitative data on mineral abundances and distributions to address hazardous-mineral distributions in those subunits of the Topopah Spring Tuff that may contain the potential repository level. These data should be obtained and examined to generate predictive models of (1) the distributions of silica polymorphs in the potential host rock (very preliminary data suggest variability in cristobalite/quartz ratios may vary with extent of lithophysal crystallization) and (2) zeolite distributions within the potential repository level (several zeolites have been found in fractures of the potential host rock; stellerite has now been found as a matrix mineral within the potential host rock in both UZ-16 and UZ-14; and the lower part of the devitrified Topopah Spring Tuff is a common location for erionite occurrence). To model these hazardous mineral abundances in three dimensions, it is vital to obtain data from both the ESF main drift and the East-West drift for integration with the existing quantitative mineral determinations obtained from drill holes.

b) There is a need to obtain quantitative data for both size and mineralogy of particulates generated from alcove and drift mining operations. These data should be collected for the full variety of drilling and mining equipment used in both drift and alcove operations, with special attention paid to the link between excavated rock and particulate form as a function of the amount of water usage. These data will be important in evaluating those approaches to excavation practice that will address OSHA respiratory protection standards without compromising testing or construction.

6. Scope Differences from the Baseline:

New work.

7. Key Assumptions:

Access to main drift is available. East-west drift will be mined on schedule and access will be available. TCO assistance will be available for help in collecting samples.

8. Cost Rationale:

Staffing necessary to obtain over 250 quantitative XRD analyses of rocks and particulates, as well as over 75 Horiba particle size analyses.

FY98 Cost Rationale

Total FTEs, FY98:
0.8 FTE of staff mineralogist, Labor Category 101A
FTE of technician, Labor Category 101C

FY99 Cost Rationale

Total FTEs, FY99:
0.5 FTE of staff mineralogist, Labor Category 101A
FTE of technician, Labor Category 101C

9. Level IV Milestones:

(Predictive Report Milestone, due 15 November 1997, can be found in TR39BFB6, "E-W Drift Predictive Reports.")

Preliminary Report on Hazardous Mineral Distributions at Yucca Mountain with Application to Repository testing, Design, and Operation (due 7/30/98)

Final Report on Hazardous Mineral Distributions at Yucca Mountain with Application to Repository testing, Design, and Operation (due 6/30/99)

10. Level IV Milestone Acceptance Criteria:

Preliminary Report on Hazardous Mineral Distributions at Yucca Mountain with Application to Repository testing, Design, and Operation (due 7/30/98)

This report will summarize the data collected up to the date of compilation. The majority of the information from East-West drift mining will have been completed at this point. A model of hazardous mineral distributions will be presented, including the new information to be obtained from this drift. Included in this report will be the analysis of particulate sizes and mineralogies as applied to actual mining operations and practices at the site.

Final Report on Hazardous Mineral Distributions at Yucca Mountain with Application to

Repository testing, Design, and Operation (due 6/30/99)

This report will summarize all of the data obtained to date on hazardous mineral distributions, including particulate size and mineralogy data for operations involving alcove excavations as well as TBM and drilling operations. The model of hazardous mineral distributions developed in the preliminary report will be evaluated against the most recent data. The report will include recommendations on practices and operations that can mitigate hazardous mineral concerns through modifications to mining operations and to repository design. Impact on License Application will be specifically addressed.

11. Attachments and References:

References:

Bish, D. L., and S. J. Chipera (1987) Detection of trace amounts of erionite in samples using X-ray powder diffraction and profile refinement. Proceedings of the Clay Minerals Society 24th Annual Meeting, Socorro, New Mexico, p. 32.

Bish, D. L., and Chipera, S. J. (1991). Detection of trace amounts of erionite using X-ray powder diffraction: Erionite in tuffs of Yucca Mountain, Nevada, and central Turkey. Clays & Clay Minerals 39, 437-445.

Bish, D. L., Chipera, S. J., Guthrie, G. D., and Vaniman, D. T. (1995) The Occurrence and Distribution of Erionite in Drill Holes at Yucca Mountain, Nevada. LANL letter report LA4058, 20 pp.

Guthrie, G. D., Jr. (1992) Biological effects of inhaled minerals. *American Mineralogist*, 77:225–243. NNA.94104.0054

Guthrie, G. D., Jr. (1993) Mineral characterization in biological studies. In *Health Effects of Mineral Dusts*, G. D. Guthrie Jr. and B. T. Mossman, eds., Mineralogical Society of America, Washington, 251–273.

Guthrie, G. D., Jr., and Mossman, B. T. (1993) *Health Effects of Mineral Dusts*. In P. H. Ribbe, Ed., Reviews in Mineralogy, 28, 584 pp. Mineralogical Society of America, Washington.

Guthrie, G., D., Jr., K. McLeod, N. Johnson and D. Bish (1992) Effect of exchangeable cation on zeolite cytotoxicity. *Goldschmidt Conference Abstracts with Program*, p. A-46.

Guthrie, G. D. Jr., Bish, D. L., Chipera, S. J., and Raymond, R. Jr. (1995) Distribution of potentially hazardous phases in the subsurface at Yucca Mountain, Nevada. Los Alamos National Laboratory report LA-12573-MS, 41 pp.

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR32112FB6
2. Summary Account Title: Petrology of Flow Paths in the E-W Drift
3. Summary Account MGR/ORG:
4. Status of Change: Revised x New
5. Scope Description: The E-W Drift will provide subsurface access to a portion of Yucca Mountain with higher net infiltration than the Main Drift and Ramps. The E-W Drift may intersect traces of the Sundance fault and the area below a low-angle thrust fault; both of these features are loci of fast infiltration in the Main Drift. The drift will terminate at the Solitario Canyon fault, a major block-bounding fault, where an alcove will be constructed. In conjunction with the chlorine-36 studies of the Water Movement Test, rock alteration and deformation associated with fast pathways, and, for comparison, with slow pathways, will be analyzed by field and laboratory techniques. The resulting contributions to a database of mineralogic and petrologic attributes will be used to test hypotheses about the origins, longevity, and connectivity of fast paths. In particular, we will examine whether fast paths, if they are found, below higher infiltration areas have distinctive characteristics that would cause us to revise our conceptual models of fast-path existence.

6. Scope Differences from the Baseline: Addition of flow path mineralogic and textural characterization in E-W Drift.

7. Key Assumptions: 1) TCO escort will be available for 3 2-day trips to the E-W Drift. 2) Samples from the boreholes associated with the drift will be available for study.

8. Cost Rationale:

FY98 cost:

Labor Category 101B Mineralogist-Petrologist. 0.25 FTE: Expertise in field-scale and laboratory studies of mineralogic and textural alteration especially in welded tuffs. Expertise in syngenetic alteration and particulate transport. Knowledge of appropriate quality assurance requirements.

Labor Category 101C XRD Technician, 0.05 FTE: Expertise in sample preparation, analysis, and interpretation of quantitative X-ray diffraction data for Yucca Mountain tuffs. Knowledge of appropriate quality assurance requirements.

FY 99 cost:

Labor Category 101B Mineralogist-Petrologist. 0.2 FTE: Expertise in field-scale and laboratory studies of mineralogic and textural alteration especially in welded tuffs. Expertise in syngenetic alteration and particulate transport. Knowledge of appropriate quality assurance requirements.

Labor Category 101C XRD Technician, 0.05 FTE: Expertise in sample preparation, analysis, and interpretation of quantitative X-ray diffraction data for Yucca Mountain tuffs. Knowledge of appropriate quality assurance requirements.

9. FY 98 Level IV Milestone:

(Predictive Report Milestone, due 15 November 1997, can be found in TR39BFB6, "E-W Drift Predictive Reports.")

Title: Progress Report on Characterization of Fast Paths
Due: 30 September 1998

FY 99 Level IV Milestone:

Title: Final Report on Characterization of Fast Paths and Transmissive Features
Due: 30 September 1999

10. Level IV Milestone Acceptance Criteria:

Progress Report on Characterization of Fast Paths

A letter report will describe the mineralogic and textural analysis of discrete transmissive features in the E-W Drift and the associated boreholes. Utilizing the results of chlorine-36 analyses and isotopic studies of secondary minerals, patterns of fast-path distribution in the Drift will be compared to data from the ramps and main drift. Analysis of the PTn sections in the boreholes will focus on detection of features that affect transmissivity, and the results will be related to observations from the approximately underlying E-W Drift.

Final Report on Characterization of Fast Paths and Transmissive Features

This letter report will complete and summarize the investigations of fast pathways, transmissive features, and areas of slow transport in the E-W Drift. A detailed investigation of the Solitario Canyon fault alcove will combine textural and mineralogic studies with the results of the chlorine-36 and other isotopic analyses of fluid flow and secondary-mineral deposition, as well as chloride mass-balance studies of infiltration. The report will evaluate conceptual models of infiltration on the basis of the data described above.

11. References:

Levy, S., Sweetkind, D., Fabryka-Martin, J., Dixon, P., Roach, J., Wolfsberg, L., Elmore, D., and Sharma, P. (1997). Investigations of Structural Controls and Mineralogic Associations of Chlorine-36 Fast Pathways in the ESF. Los Alamos National Laboratory YMP Milestone Report SP2301M4.

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: OG32211FB2

2. Summary Account Title: Stratigraphic Descriptions for SBT Boreholes

3. Summary Account MGR/ORG: Robert Craig/USGS

4. Status of Change: _X_ Revised ____ New

5. Scope Description:

The added scope to this summary account will provide input to the stratigraphic reports for the SD-11 borehole planned to be drilled in FY 98/FY99 and the SD-13 borehole planned to be drilled in FY 99. Stratigraphy will be developed using core, cuttings, borehole geophysical logs, television camera logs, and other materials as appropriate and available. The stratigraphic data will support UZ and SZ hydrologic testings and analysis/interpretation of test results, and be input into the 3-D geologic framework model, which in turn provides the geologic basis for the hydrologic flow and radionuclide transport models. This work will be done in conjunction with SA TR32211FB1, with the geologists in both accounts providing input and review to each other.

The focus of work in this SA will be on the analysis of cuttings, core, and television/video and geophysical logs of the two boreholes, to develop elevations of lithologic contacts, borehole stratigraphy and lithologic descriptions for the borehole. Log descriptions will identify lithologic unit, extent and degree of alteration, vitrification, or welding; and to the extent possible the occurrence of pumice, lithic clasts, phenocrysts, or fracture fill. These data will be documented for subsequent technical review and submitted to the RPC. The integration of the available stratigraphic and rock mass data will be summarized in the Level 4 borehole reports developed under account TR32211FB1. Development of the descriptive text to these reports will be a joint effort between the two accounts.

Work scope in this account also includes on-site identification of stratigraphy for the start of the coring interval in both SD boreholes, and providing stratigraphic input as needed for the hydrologic studies to be conducted in the borehole.

The logging of the SD-11 borehole logging will begin in FY 98 and be completed in FY 99. Effort in FY 99 also includes logging/reporting of borehole SD-13, and assisting in the development and review of the summary reports produced for both SD-11 and SD-13 under TR32211FB1.

OUTPUTS:

Data developed in this account (depth of contacts, lithologic descriptions) will be directly input into the spreadsheet program by which the integrated borehole stratigraphic log will be developed, and submitted to the technical data base as TDIFs. It is anticipated that preliminary contacts will be identified by one month after the drilling for that borehole is completed. Lithologic descriptions are to be completed two months after the drilling is over. The final report (SA TR32211FB1) is anticipated to be completed 3 months after the borehole is completed.

USW SD-11

A level 4 milestone (SPG21CM4, due 15 Jan 99) will consist of a memorandum to the USGS TPO identifying lithostratigraphic contacts with associated depth in borehole USW SD-11. Memorandum will be delivered approximately one (1) month after completion of the borehole.

A level 4 milestone (SPG21DM4, due 15 Mar 99) will consist of a memorandum to the USGS TPO detailing the lithostratigraphy (lithostratigraphic log) for borehole USW SD-11. Memorandum will be delivered approximately three (3) months after completion of the borehole construction, borehole geophysical logging, and television logging. The completion of the borehole lithostratigraphic log is dependent upon the availability of the borehole core and cuttings samples, geophysical logs, and TV logs.

USW SD-13

A level 4 milestone (SPG21AM4, due 03 May 99) will consist of a memorandum to the USGS TPO identifying lithostratigraphic contacts with associated depth in borehole USW SD-13. Memorandum will be delivered approximately one (1) month after completion of the borehole, including the collection and release of borehole geophysical logs.

A level 4 milestone (SPG21BM4, due 02 Jul 99) will consist of a memorandum to the USGS TPO detailing the lithostratigraphy (lithostratigraphic log) for borehole USW SD-13. Memorandum will be delivered approximately three (3) months after completion of the borehole construction, borehole geophysical logging, and television logging. The completion of the borehole lithostratigraphic log is dependent upon the availability of the borehole core and cuttings samples, geophysical logs, and TV logs.

6. Scope Differences from the Baseline:

New Scope is being added to SA proposed for SD-6/WT-24 C/SCR. A title change for the summary account is also proposed with this C/SCR.

7. Key Assumptions:

The boreholes are constructed and adequate, qualified lithologic samples, geophysical logs, and television camera logs are available for inspection and interpretation. Personnel are available and fully supported by the project to conduct this work. Cost rationale is predicated on other project participants assisting with the lithostratigraphic logging of these boreholes. Minimal on site representation by the USGS will be required during construction of the boreholes. The first set of geophysical logs will be available for SD-11 at the middle of June 98; and for SD-13 at the middle of February 99; no significant amount of logging of cuttings will be conducted without paper (field) copies of the geophysical logs.

Geologic contacts to be identified in the logging effort and in the report are those of the ISM2 3-D Geologic Framework Model plusTpcpv2, Tptrv2, Tptpv2, and the top of RHH. Lithologic descriptions will be made of the stratigraphic intervals between these contacts.

The geophysical character of the above contacts will have been identified by the effort currently underway in SA 0G395FB1.

Core recovery data and RQD analyses will be provided from WBS 1.2.3.5.1. Structural log data, derived from the review of borehole video logs, will be collected concurrently with the effort described herein, but with FY'98 planning funds.

Level 3 borehole reports, in which the matrix properties data from WBS 1.2.3.3.1.2.3 will be included, will be scheduled for these boreholes in FY'98 planning. A discussion of the matrix properties analyses for the individual boreholes will not be included in the borehole reports produced under this account in this C/SCR.

8. Cost Rationale: ($110K) ($39K - FY98; $71K - FY99)

Labor (0.64 FTE):

Geologist GS-14 (0.25 FTE): Principal investigator, with expertise in the volcanic stratigraphy at Yucca Mountain to assist in the construct of borehole lithostratigraphic logs, conduct technical reviews, and provide limited support to project personnel conducting hydrologic testing in the boreholes and/or interpreting the results of borehole GP logs.

Geologist GS-12 (0.35 FTE): Expertise in the volcanic stratigraphy at Yucca Mountain to assist in the construct of borehole lithostratigraphic logs, conduct technical reviews, and provide limited support to project personnel conducting hydrologic testing in the boreholes and/or interpreting the results of borehole geophysical logs.

Hydrologist GS-14 (0.04 FTE): Expertise as supervisory hydrologist to provide management support to staff conducting this activity.

Travel ($8K):

Eight trips from Denver to Las Vegas/Yucca Mountain to support on site lithostratigraphic work; to construct borehole lithostratigraphic logs using core, cuttings, geophysical and TV logs, etc. at the SMF; and, to attend meetings related to these boreholes. Two trips from Denver and Las Vegas to other various other project locations to attend meetings, consult with other project participants, and present data concerning the lithostratigraphy of these boreholes.

Other Direct Costs ($4K):

Miscellaneous equipment, supplies, and services required to support the interpretation of borehole data and the construction of borehole lithostratigraphic logs.

Work by Others ($27K):

One (1) geologist with expertise in volcanic stratigraphy, preferably the volcanic stratigraphy at Yucca Mountain, to assist with the production of the borehole lithostratigraphic logs and conduct technical reviews of the lithostratigraphic logs and any related reports. One (1) quality assurance implementation/data specialist with experience in Yucca Mountain quality assurance standards and data package preparation.

9. Level III Milestones:

None

10. Level III Milestone Acceptance Criteria:

N/A

11. Attachments and References:

12. Schedule:

Activity	Early Start	Early Finish
Construct SD-13 Lithostratigraphic Log	16 Dec 98	02 Jul 99
Construct SD-11 Lithostratigraphic Log	23 Apr 98	15 Mar 99

BASIS OF ESTIMATE
FOR THE INITIAL ACTIVITIES OF THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: TR32211FB2

2. Summary Account Title: Stratigraphic Descriptions for SBT Boreholes

3. Summary Account MGR/ORG: Biggar/SPO-WCFS

4. Status of Change: __X__ Revised ____ New

5. Scope Description:

The added scope to this summary account will provide input to stratigraphic reports for the SD-11 and SD-13 boreholes planned to be drilled in FY'98. Borehole stratigraphy will be developed using core, cuttings, borehole geophysical logs, television camera logs, and other materials as appropriate and available. The stratigraphic data will be input into the 3-D geologic framework model, which in turn provides the geologic basis for the hydrologic flow and radionuclide transport models. This work will be done in conjunction with SA 0G32211FB2, with the geologists in both accounts providing input and review to the other, and developing the descriptive text of the level 4 reports.

This summary account will provide for development of borehole stratigraphy and lithologic descriptions for the USW SD-11 and USW SD-13 boreholes, and compilation of a level 4 geologic report for the boreholes, which are planned to be drilled in the last half of FY98 and in FY99. Borehole stratigraphy will be developed using core, cuttings, borehole geophysical logs, television camera logs, and other materials as appropriate and available. Descriptions of the core will identify lithologic units, contacts between units, extent and degree of alteration, virtrification, or welding; the occurrence of pumice, lithic clasts, phenocrysts, or fracture fill; presence or absence of bedding or other depositional features, fault zones or shear zones, and joints or fractures and fracture frequency; percent core recovery; and RQD (rock quality designation). The available stratigraphic, structure, and rock mass data will be integrated and summarized in Level 4 deliverables for each borehole.

The workscope in FY98 includes analysis of core and cuttings for SD-11 to identify stratigraphic contacts, using the core, cuttings, and geophysical and video log data as they are available. The remainder of the core and lithologic descriptions for SD-11, all efforts for SD-13, as well as deveopment and review of Level 4 reports for both boreholes, will be done in FY99.

OUTPUTS: Level 4 reports:

Title: Stratigraphy of the USW SD-11 Drill Hole, Yucca Mountain, Nevada
Deliverable ID: SP322DM4
Due Date: 30 March, 1999
Deliverable Description: The report will consist of text providing a location description, drilling history, method of study, an overview of the geology (stratigraphy, structure, alteration) observed in the USWSD-11 borehole and of the geophysical logging and individual log response (summarized from deliverable in SA TR3B2GB1), the rock quality data observed in the cored portions of the borehole, and discussion of any anomalous patterns or observations. The borehole data will be portrayed on a geologic core log showing geologic contacts, alteration, devitrification, welding, fracuring, geology, lithologic description, core recovery, and geophysical log data. The log will be presented at a scale of 1 inch = 10 ft. Data ascension numbers will be included for supportive data submitted to the Technical Data Base.

Title: Stratigraphy of the USW SD-13 Drill Hole, Yucca Mountain, Nevada
Deliverable ID: SP322CM4
Due Date: July 15, 1999
Deliverable Description: The report will consist of text providing an overview of the geology (stratigraphy, structure, alteration) observed in the USW SD-13 borehole, the rock quality data observed in the cored portions of the borehole, and discussion of any anomalous patterns or observations. The borehole data will be portrayed on a geologic core log showing geologic contacts, alteration, devitrification, welding, fracuring, geology, lithologic description, core recovery, and geophysical log data. The log will be presented at a scale of 1 inch = 10 ft. Data ascension numbers will be included for supportive data submitted to the Technical Data Base.

6. Scope Differences from the Baseline: New Scope is being added to SA proposed for SD-6/WT-24 C/SCR. A title change for the summary account is also proposed with this C/SCR.

7. Key Assumptions:

The boreholes are constructed and adequate, qualified lithologic samples, geophysical logs, and television camera logs are available for inspection and interpretation. The first set of geophysical logs will be available for SD-11 in early July, 1998; and for SD-11 at the middly of July, FY'99; input to last of two reports will be completed at end of calender year '98; no significant amount of logging of core will be conducted without paper (field) copies of the geophysial logs. Structural (aka fracture) logs will not be constructed for the boreholes.

Geologic contacts to be identified in the logging effort and in the report are those of the ISM2 3-D Geologic Framework Model plusTpcpv2, Tptrv2, Tptpv2, and the top of RHH. Lithologic descriptions will be made of the stratigraphic intervals between these contacts.

The geophysical character of the above contacts will have been identified by the effort currently underway in SA 0G395FB1.

Core recovery data and RQD analyses will be provided from WBS 1.2.3.5.1. Structural log data, derived from the review of borehole video logs, will be collected concurrently with the effort described herein, but with FY'98 planning funds.

Level 3 borehole reports, in which the matrix properties data from WBS 1.2.3.3.1.2.3 will be included, will be scheduled for these boreholes in FY'98 planning. A discussion of the matrix properties analyses for the individual boreholes will not be included in the borehole reports produced under this account in this C/SCR.

8. Cost Rationale:

Labor: (1.1 FTE)

0.3 FTE 101B geologist, with expertise in the volcanic stratigraphy at Yucca Mountain to conduct technical reviews.

0.8 FTE 101B geologist, principal investigator, with expertise in the volcanic stratigraphy at Yucca Mountain to construct borehole lithostratigraphic logs, conduct technical reviews, and prepare summary reports.

0.01 FTE 100C for management, oversight and review

Travel ($10k):
Four 5-day trips from Albuquerque to Las Vegas/Yucca Mountain to support on site lithostratigraphic work; to review borehole lithostratigraphic logs using core, cuttings, geophysical and TV logs, etc. at the SMF; and, to attend meetings related to these boreholes. One 2-day trip from Albuquerque to Denver to attend meetings, consult with other project participants, and present data concerning the lithostratigraphy of these boreholes.

Other Direct Costs:
Miscellaneous equipment, supplies, and services ($6K).

9. Level III Milestones: None.

10. Level III Milestone Acceptance Criteria: N/A

11. Attachments and References: N/A

12. Schedule:

Log and prepare report for USW SD-11 borehole:	Apr '98 - Mar ' 99
Log and prepare report for USW SD-13 borehole:	Dec '98 - Jul ' 99

TECHNICAL BASIS
FOR THE REQUIRED ACTIVITIES FOR THE ENHANCED CHARACTERIZATION OF THE REPOSITORY BLOCK

1. Summary Account Number: QG32212EB2

2. Summary Account Title: Complete Site Area Geologic Map

3. Summary Account MGR/ORG: Robert Craig - USGS

4. Status of Change: _X_ Revised ___ New

5. Scope Description:

FY97: Prepare a predictive cross-section and prepare a memorandum to the USGS TPO on the 1) nature of fracturing; 2) a prediction of footwall/hanging wall deformation, and; 3) nature of faulting to be in the geology to be encountered along the alignment of the ECRB drift. The model for the nature of footwall deformation along the Solitario Canyon Fault to be developed will concentrate on the area to be encountered by the ECRB drift and will help constrain future repository design and construction efforts. The cross-section will incorporate existing mapping with minor field checking and confirmation of the Central Block (1:6,000-scale) map area. The cross-section and memorandum will address the number of fault splays off the Solitario Canyon Fault, the displacement along the faults, and the lithologic contacts to be encountered. The memorandum on the nature of fracturing will concentrate on the relative fracture intensity expected to be encountered in each major lithologic unit, the variations in dominant fracture orientations and possibly fracture sets to be encountered. The nature of footwall deformation and associated fracturing near the Solitario Canyon Fault will be described. The memorandum will be concise and focused on the ECRB drift area.

6. Scope Differences from the Baseline:

This new work was not included in the original FY97 plans. The necessity to conduct this work is a result of the expressed desire of regulatory groups to assess the predictive capabilities of the project for the geologic character of the repository block. This work will also assist construction planning and design by providing data on expected geologic conditions to be encountered.

7. Key Assumptions:

Adequate resources will be made available to complete this work.

8. Cost Rationale: ($118K) ($67K - FY97; $51K - FY98)

The cross-section preparation, supporting field review and traverse, digitization, submittal of data package(s), and writing and reviewing the report.

Staffing: 1.0 FTE

Geologist GS-14(0.25 FTE): Expert in structural geology, with emphasis on Yucca Mountain Central Block structural geology and the creation of predictive cross-sections.

Geologist GS-13(0.25 FTE): Expert in structural geology, with emphasis on Yucca Mountain Central Block structural geology and the creation of predictive cross-sections.

Computer/GIS Specialist GS-12(0.25 FTE): Expert in the creation of maps and cross-sections using GIS and other computer graphics systems.

Geologist GS-12(0.25 FTE): Expert in the collection and analysis of fracture data, specifically in volcanic terranes.

Travel: ($4K)

6 trips from Denver to NTS to conduct field verification of structural components of predictive cross-section.

Other Direct Costs: ($4K)

Computer supplies to produce predictive cross section, miscellaneous field supplies expended during field verification, and miscellaneous office supplies.

9. Level IV Milestones:

A level 4 milestone (No. SPG22M4, due14 Nov 97) will consist of a memorandum to the USGS TPO presenting the predictive cross-section.

10. Level IV Milestone Acceptance Criteria:

A cross-section (1:6,000-scale) and concise memorandum will be prepared presenting a prediction on the nature of faulting and fracturing to be encountered in the ECRB drift. The memorandum will outline a simple model for footwall deformation to be encountered as well as the relative variations in the characteristics of fracturing in the rock mass traversed.

11. Attachments and References:

12. Schedule:

Activity	Early Start	Early Finish
Prepare Predictive Cross-Section and Memorandum	01 Jul 97	14 Nov 97

July 2, 1997 (7:20pm)