NVO-196-9

NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS

FY 1979 PROJECT PLAN

MARCH 1979

UNITED STATES
DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE
LAS VEGAS, NV

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FOREWORD

Pursuant to the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and the Department of Energy Organization Act, the Department of Energy (DOE) is assigned the responsibility for the development and operation of facilities for the long-term storage and disposal of radioactive waste originating from DOE facilities and high-level radioactive waste originating from commercial facilities.

As a part of the DOE National Waste Terminal Storage (NWTS) Program, the Department of Energy/Nevada Operations Office (DOE/NV) has been assigned the responsibility to evaluate the suitability of geologic units and media located on or near the Nevada Test Site (NTS) for the development and operation of disposal facilities for commercially generated high-level radioactive wastes and wastes from DOE facilities. The Nevada Nuclear Waste Storage Investigations are (NNWSI), the DOE/NV projects which will (1) carry out this responsibility and (2) conduct DOE experiments and/or tests with commercial wastes which generically support the NNWSI Program.

This document presents the management and cost for the Nevada Nuclear Waste Storage Investigations and provides a complete description of the overall project, management structure, technical approach, and work breakdown structure.

The Project Plan is subject to periodic review and revision by the NV Project Office as technical and/or budgetary changes merit. Publication of these changes is not planned.

This document is organized into five major sections. Section I summarizes the history of the project and indicates a potential future course of action. FY 1979 project work is briefly described in Section II. Section III outlines the delegated responsibilities of all project management functions. A list of critical questions that guide the technical approach of the project are presented in Section IV. Section V contains subtask work plans which outline the work in detail for this fiscal year.

SECTION I

PROJECT HISTORY

The Nevada Nuclear Waste Storage Investigations (NNWSI) are managed by the DOE/NV Operations Office and are conducted by the United States Geological Survey (USGS) and three national laboratories: Los Alamos Scientific Laboratories (LASL), Lawrence Livermore Laboratory (LLL), and Sandia Laboratories (SLA). Other support work is provided by NV support contractors: Reynolds Electrical & Engineering Co., Inc. (REECo); Fenix & Scisson, Inc. (F&S); Holmes & Narver, Inc. (H&N); John A. Blume & Associates (JAB); and others. The project initially defined specific project goals, requirements, and a management structure in FY 1977.

Investigations during FY 1978 did not preclude the NTS from continued consideration for a radioactive waste repository. One potential argillite site, the central block of the Syncline Ridge, was disqualified because of its structural complexity which precluded realistic characterization of the site in the absence of excessive and perhaps destructive drill hole exploration. Subsequently, the proximity of Syncline Ridge to the Yucca Flat principal weapons testing area precluded further consideration of Syncline Ridge. In addition, other sites on the NTS including the Climax Granite Stock, northern Syncline Ridge Argillite Block, Twinridge Granite Stock, and Timber Mountain granite and tuff were removed from consideration because of their proximity to active or potential weapons testing areas. As a result of these potential interference decisions, the FY 1978 project was redirected to exploration in the southwestern portion of the NTS. This emphasis on the exploration of southwestern NTS continues to be the guidance for formulation of the FY 1979 project plan.

Media investigations during FY 1978 initially concentrated on argillite and granite. Each has shown favorable properties which indicate they should continue to be evaluated for consideration as an emplacement medium. Volcanic tuff properties identified during FY 1978 indicate this rock type has favorable aspects worthy of further evaluation and assessment. FY 1979 efforts will continue to assess the suitability of tuff as well as argillite and granite.

Assuming selection of a candidate repository site on the NTS by the end of FY 1981, the FY 1979 exploration and media studies, all pertinent data, analysis, and documents required for a high-level waste repository license application will be prepared for submission to the Nuclear Regulatory Commission. Studies of the selected site and emplacement media will intensify to support preparation of required licensing documentation. Concurrently, conceptual repository design efforts by participants in the exploration project will be supplemented by engineering designs performed by a yet to be selected A-E contractor. If FY 1979 studies exclude areas on the NTS from consideration, subsequent off-site exploration will be intensified. In this case, preparation of any license application would be significantly delayed.

Additional FY 1978 project history may be obtained in the "Annual Report--NTS Terminal Waste Storage Project--FY 1978," NVO-196-7.

SECTION II

FY 1979 PROJECT

Overall project guidance is provided in II.A. below. Project activities are divided into seven major tasks briefly described in II.B. A master summary of the schedules, milestones, and budgets keyed to the work tasks is provided in II.C.

A. PROJECT DESCRIPTION

The Nevada Nuclear Waste Storage Investigations for FY 1979 are organized into seven tasks. Each task is further divided into subtasks and activities described in detail in Section V of this document. A brief description of the seven tasks follows.

Task 1--Seismic Investigations

The ground motion resulting from weapons testing at the NTS will continue to be investigated in FY 1979. Data associated with weapons tests will be recorded by the instrumentation network deployed in FY 1978 to provide a substantial data base for future site specific analysis. Measurements will be made both at the surface and, where possible, below the surface near candidate repository locations.

Task 2--Geological Investigations

Geologic investigations will be conducted to determine tectonic, seismic, volcanic, and erosional factors inherent to southern Nevada in general and to various specific areas at the NTS in particular. Although these investigations will take a number of years to complete, data gathered during FY 1979 and prior years will be continually analyzed to provide information about areas where geologic investigations should be further concentrated as well as to evaluate selected areas. Geologic, geophysical,

and hydrologic evaluations of prospective areas on the NTS and in the state of Nevada will be coordinated to identify the most favorable geohydrologic settings. Areas judged as potentially suitable for waste isolation in tuff, argillite, and/or granite media will be identified in FY 1979.

Task 3--Media Investigations

Laboratory and field experiments and generic modeling will be conducted during FY 1979 to determine the suitability of candidate lithologies occurring at the NTS. Although these experiments and studies will continue for a number of years, effort expended during FY 1979 will emphasize obtaining information on thermal, mechanical, and chemical effects that have major impact on the suitability of candidate media. Media specific data from individual study areas will be compared and contrasted by laboratory experiments to determine generic media properties. Upon approval of experimental plans, phenomenological in situ experiments in tuff will be performed. The Syncline Ridge argillite and Climax Stock granite heater experiments initiated in FY 1978 will be concluded.

Task 4--NTS Engineering and Technical Support

This task provides general engineering and field support to project Tasks 1, 2, and 3 (support to Task 7 is integral to the task) by NV prime architect-engineering contractors (F&S and H&N) and the prime operating contractor (REECo). These activities are of a general nature and not appropriately assigned to other tasks. This miscellaneous field support will include general engineering, design, drilling, and technical support by A-E contractors. F&S geologists will monitor drilling activities and perform other requested work which requires geologic expertise. This task will also provide for vehicles, sample shipment, core library support, etc., involved with field activities at the NTS.

Task 5--Quality Assurance

This task provides the quality assurance support necessary to assure that project activities are planned and accomplished to a quality level sufficient for current and anticipated regulatory requirements. Development of a quality assurance plan, begun in FY 1978, will be finalized and implemented in FY 1979. All activities presented in this Project Plan will be in accordance with the quality assurance plan. All organizations responsible for the tasks or subtasks, including the NTS support contractors, will conduct their operations in accordance with specific organization assurance plans approved by the Project Manager and included in the overall quality program.

Task 6--Technical Overview

This task provides for technical overview of the Nevada Nuclear Waste Storage Investigations by the Technical Overview Contractor, Sandia Laboratories. It includes assisting the DOE Project Manager in establishing technical objectives, in the preparation and maintenance of project and management plans, in coordination with HQ and NRC on technical matters, and in technical review and evaluation of project status and cost reports. As part of this task, a Site Selection Working Group chaired by the Technical Overview Contractor will be formed to develop and apply criteria for repository siting.

Task 7--Spent Fuel Test--Climax Stock

This task provides for a test of the geological storage of spent fuel assemblies in granite. Activities initiated in FY 1978 will be expanded during FY 1979. Emphasis in FY 1979 will be on design and construction of a test facility in the Climax Stock at the NTS; design and fabrication of spent fuel canisters; design and fabrication of a canister transport system; and development of documentation covering test plans, safety assessment, and operational procedures. Support analytical modeling to predict thermal and mechanical responses of the test facility will be

conducted and compared to real-time data gained in subsequent years. All major facility construction will be completed in FY 1979. Deployment of field instrumentation, emplacement of array heaters, and data acquisition systems will begin in early FY 1980. Following Project Manager approval of procedures, and successful completion of dry runs, spent fuel canister emplacement will begin by July 1980. NTS general engineering and field support for this task will be provided by NV prime architect-engineering contractors (F&S and H&N) and the prime operating contractor (REECo).

B. PROJECT STRUCTURE, SCHEDULES, MILESTONES, AND BUDGET SUMMARY

Four kinds of project summaries are presented in this subsection: Work Breakdown Structure Chart, Milestone Schedule Chart, Milestone Listing, and Budget Summary Chart.

Work Breakdown Structure--The Work Breakdown Structure Chart presents the task-subtask framework established for the project. This framework has been organized to expedite planning and reporting of investigative work in a logical and consistent manner.

Milestone Schedule--The Milestone Schedule Chart presents the schedule for planned achievement of all milestones established for investigative tasks for FY 1979. This chart is keyed to the Milestone Listing. Triangular and square symbols represent designations for intermediate and major milestones, respectively. Major milestones are those which either (a) support major project decisions, (b) result in significant technical reports, and/or (c) provide critical input to other subtasks. They are consecutively numbered for the overall project. Intermediate milestones indicate subtask-related programmatic achievements and are numbered consecutively for each individual subtask in the milestone listing. On the Milestone Schedule, major milestone numbers are shown. However, for clarity, intermediate milestone numbers are omitted but can be derived from the Milestone Listing.

Milestone Listing--A Milestone Listing is provided for the three major investigative tasks (Tasks 1, 2, and 3), the administrative tasks (Tasks 5 and 6), and the National Project support task (Task 7). These listings present the sequence of all significant planned accomplishments, reports, and events for the FY 1979 project. Task 4 is a continuing support activity subject to overall programmatic requirements and, therefore, specific milestones are not provided.

Budget Summary--The Budget Summary for FY 1979 is listed in accordance with the Work Breakdown Structure, with funding additionally categorized by agencies, laboratories, and other NV contractors.

C. NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS MILESTONE LISTING

Task 1--Seismic Investigation

1.1--Data Processing and Analysis

1.	Letter status report of results to date (R)	January 79

1.2--Weapons Test Ground Motion Measurements

1.4--Ground Motion Effects w/Depth

1.	Interim report outlining suitable models and outlining proposed results (R)	January 79
2.	Complete draft of final report for review and publication (R)	May 79

Task 2--Geological Investigation

2.1--Geologic Project Coordination

2.2--Geologic Investigations

2.2.1--Shale/Argillite

1.	Complete draft report on geology of the UE17e drill hole (R)	November 78
2.	Complete draft report on geohydrology of the UE17a drill hole (R)	January 79

(R) Report

3.	Complete draft report of hydraulic tests in holes UE16d and UE16f (R)	January 79
4.	Complete geologic field mapping in the Calico Hills/Topopah Wash areas	January 79
5.	Complete draft report on inventory of clay-rich bedrock and metamorphic derivatives in eastern Nevada (R)	February 79
6.	Complete draft report on geology of the Syncline Ridge area (R)	May 79
7.	Recommend potential shale/argillite areas in southern Nevada /7/	September 79

2.2.2--Tuff

1.	Complete draft report on geology of Jackass Flats (R)	April 79
2.	Complete geologic and geophysical field investigations and recommend whether or not to continue exploration of Yucca Mountain	April 79
3.	Complete draft report on inventory of tuffs contiguous to NTS	May 79
4.	Complete draft report of geology of UE25a #1 drill hole	May 79

(R) Report

/ / Major project milestone

5.	Recommend potential tuff areas in southern Nevada /7/	September 79

2.2.3--Crystalline Rocks

1.	Completion of the Calico Hills drill hole to a depth of 2,500 feet	October 78
2.	Complete geologic and geophysical field investigations of the Wahmonie area	March 79
3.	Complete geologic and geophysical field investigations and recommend whether or not to continue exploration of Calico Hills	April 79
4.	Complete draft report of geology of UE25a #3 drill hole	May 79
5.	Complete draft report on geology and geophysics of the Twinridge granitic body (R)	June 79
6.	Recommend potential granitic bodies in southern Nevada /7/	September 79

2.3--Geophysical Investigations

2.3.1--Regional and Site Investigations

1.	Complete gravity, magnetic, and electrical investigations at Calico Hills and recommend whether or not to continue exploration /4/	April 79

(R) Report

/ / Major project milestone

2.	Complete gravity, magnetic, and electrical investigations at Yucca Mountain and recommend whether or not to continue exploration /4/	April 79
3.	Complete regional electrical surveys	May 79
4.	Complete draft report on geophysical investigations of the Syncline Ridge area (R)	June 79
5.	Complete in-house limited seismic high resolution survey	June 79
6.	Complete draft report of Timber Mountain geophysical investigations (R)	August 79

2.3.2--Tectonic Support Studies

1.	Complete seismic refraction surveys	December 78
2.	Compile and interpret geophysical data relating to volcanism (R)	September 79

2.3.3--Borehole Geophysics

1.	Complete draft report of borehole geophysics of Yucca Mountain and Calico Hills drill holes (R)	March 79

(R) Report

/ / Major project milestone

2.4--Hydrological Investigations

2.4.1--Regional Hydrology

1.	Complete hydrologic reconnaissance of potential shale, tuff, and granite sites	September 79

2.4.2--Hydrology of NTS Area

1.	Complete hydraulic testing of available holes at Calico Hills and Yucca Mountain	June 79
2.	Issue draft report on results of hydraulic testing (R)	September 79

2.4.3--Paleohydrology

1.	Assess usefulness of existing core library samples for mineralogic examination	December 78
2.	Recommend whether or not to drill exploratory hole to obtain mineralogic samples	January 79
3.	Complete collection of midden samples at low elevations	March 79
4.	Complete collection of midden samples at intermediate elevations	June 79

(R) Report

5.	Complete collection of midden samples at high elevations	August 79

2.4.4--Solute-Transport Model

1.	Complete refinement of regional hydraulic model to simulate available data	February 79
2.	Complete regional solute-transport model with state-of-art K_d's /5/	June 79
3.	Complete draft report on regional solute-transport model (R)	September 79

2.4.5--Short-Term Hydraulic Effects

1.	Outline and sort data, confer with research group in Reston on modeling techniques	March 79
2.	Complete predictive model using Climax Stock data collected during FY 1978	September 79

2.4.6--Permeability Studies

1.	Construct multiunit permeameter	June 79

(R) Report

/ / Major project milestone

2.5--Tectonics, Seismicity, and Volcanism

2.5.1--Tectonics and Volcanism

1.	Complete draft report on volcanic cycles on NTS and vicinity (R)	March 79
2.	Complete field investigations of the basaltic eruptive cycle in Crater Flat /6/	July 79
3.	Complete field investigations of Quaternary stratigraphy and structure of southwestern NTS	August '79
4.	Complete draft report on Death Valley fault zone (R)	September 79

2.5.2--Seismology

1.	Begin full operation and recording of seismic net	January 79
2.	Complete draft of report on refined locations of Nevada Earthquakes (R) Nevada earthquakes (R)	May 79

2.6--Geochronology

(R) Report

/ / Major project milestone

Task 3--Media Investigations

3.1--Argillaceous Medium Investigations

3.1.1--Eleana Heater Test

1.	Turn power off	January 79
2.	Begin posttest site evaluation	February 79
3.	Rough draft report of heater experiment at Syncline Ridge (R)	September 79

3.1.2--Laboratory and Modeling Studies

1.	Letter report of scaled heater tests (R)	February 79
2.	Letter report on preliminary global modeling in argillaceous rock (R)	February 79
3.	SL preliminary letter report on comparison of material properties data for argillite from Syncline Ridge and Calico Hills (R)	May 79
4.	Draft SL report of FY 1979 activities (R)	September 79

(R) Report

3.2--Tuff Media Investigations

3.2.1--Tuff In Situ Test

1.	Submit Test Plan for GT-1	April 79
2.	Turn on experiment for GT-1 /10/	June 79
3.	Submit Test Plan for GT-2 (R)	September 79

3.2.2--Laboratory and Modeling Studies

1.	Petrology report of tuff from J-13 hole (R)	December 78
2.	Draft report of sorption studies on tuff (R)	January 79
3.	SL letter report of pretest modeling results of G-Tunnel in situ test, including material properties (R)	February 79
4.	LASL letter reports (2) of preliminary results on material from Yucca Mountain drill hole (R-2)	March 79
5.	SL letter report on far-field modeling results (R)	April 79
6.	SL letter report on preliminary thermal and mechanical properties (R)	July 79

(R) Report

/ / Major project milestone

7.	Draft data reports of results to date of SL and LASL (2) studies (R-3) /8/	September 79

3.3--Granite Medium Experiments

3.3.1--Climax Stock Heater Experiments

1.	Draft final report for Heater Test No. 1 (R)	December 78

3.3.2--Laboratory and Modeling Support

1.	Draft Technical Concept for Rock Mechanics Facility (R)	November 78

Task 4--Engineering and Technical Support

Task 5--Quality Assurance

5.1--Quality Assurance Overview

1.	Preliminary draft of Quality Assurance Plan defining project management QA activities issued	November 78
2.	QA Overview review of quality programs of DOE/NV contractors completed	January 79
3.	QA Overview review of quality programs of major participating agencies/laboratories completed	February 79

(R) Report

/ / Major project milestone

4.	Draft of Quality Assurance Plan including all activities issued	April 79
5.	Quality Assurance Plan issued (R) /2/	June 79

5.2--Participant Quality Assurance

1.	Quality plans of DOE/NV contractors submitted	October 78
2.	Quality plans of participant organizations submitted to QA Overview for review. USGS is excepted; quality plan submittal will be scheduled when procurement of a QA consultant becomes clear	November 78

Task 6--Technical Overview

6.1--Technical Overview Contractor

1.	Submit draft FY 1978 annual report (R)	December 78
2.	Draft FY 1979 Project Plan (R) /1/	January 79
3.	Draft quarterly project report (R)	February 79
4.	Draft quarterly project report (R)	May 79
5.	Draft quarterly project report (R)	August 79

(R) Report

/ / Major project milestone

6.2--Site Selection

1.	Establish site selection screening committee	April 79
2.	Establish site selection working group	June 79
3.	Submit status report of siting criteria (R) /3/	September 79

Task 7--Spent Fuel Test

7.1--Experiment Design and Procurement

1.	Complete design of major canister-handling system elements	February 79
2.	Complete draft SAD (R) /9/	April 79
3.	Complete LLL test assembly of canister transporter	September 79

7.2--Fuel Canister Engineering

1.	Complete final design reviews	February 79
2.	Complete material procurement	April 79
3.	Complete storage hole liners	September 79

(R) Report

/ / Major project milestone

7.3--Facility Construction

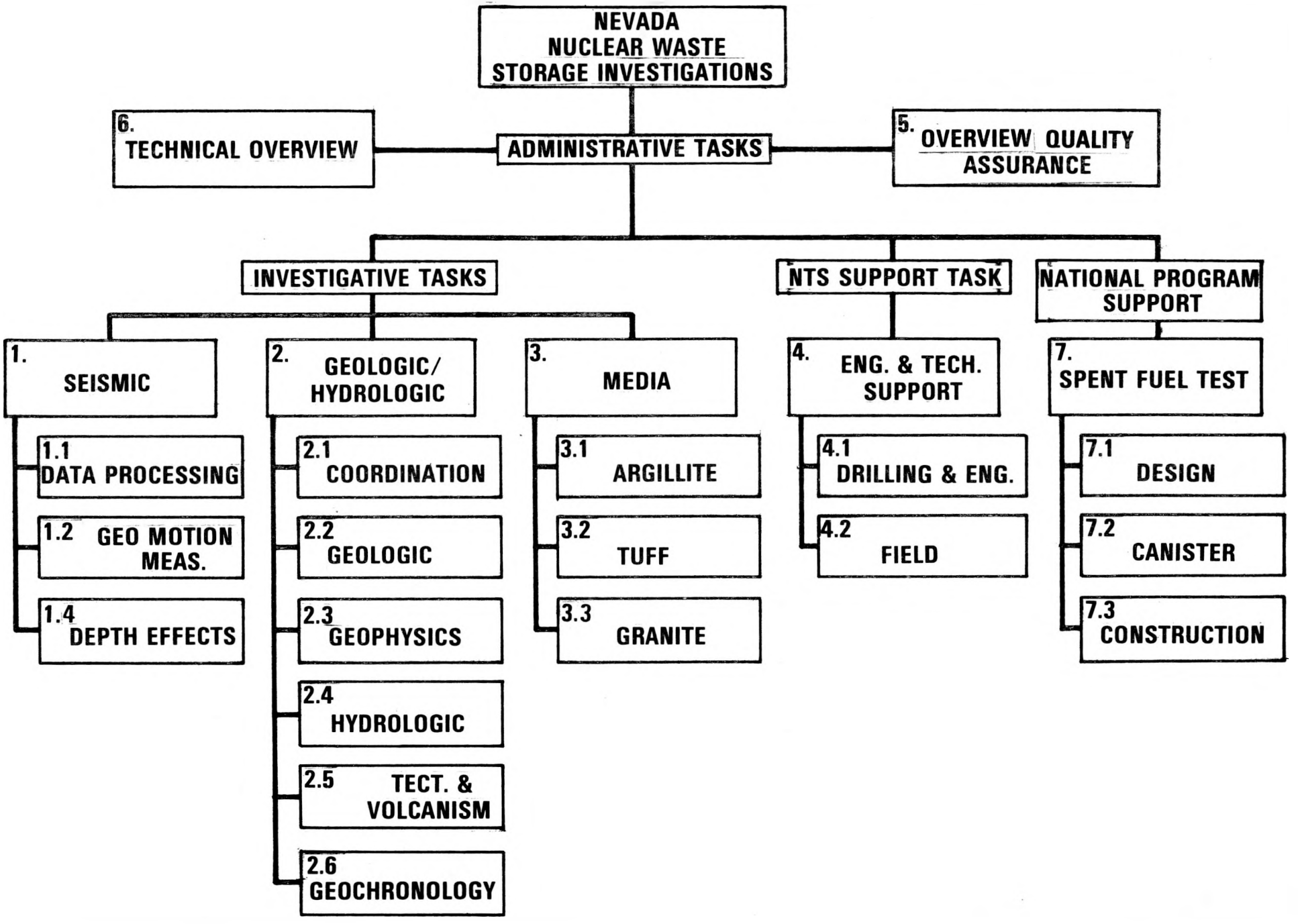
1.	Complete canister access hole	January 79
2.	Complete mining canister drift	March 79
3.	User occupancy /11/	September 79

/ / Major project milestone

NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS

1979 Milestones	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT
1.0 Seismic												
1.1				Δ								
1.4				Δ				Δ				
2.0 Geologic												
2.2												
2.2.1		Δ		ΔΔΔ	Δ			Δ				7
2.2.2							ΔΔ	ΔΔ				7
2.2.3	Δ					Δ	Δ	Δ	Δ			7
2.3												
2.3.1							4 4	Δ	ΔΔ		Δ	
2.3.2			Δ									Δ
2.3.3						Δ						
2.4												
2.4.1												Δ
2.4.2									Δ			Δ
2.4.3			Δ	Δ		Δ			Δ		Δ	
2.4.4					Δ				5			Δ
2.4.5						Δ						Δ
2.4.6									Δ			
2.5												
2.5.1						Δ				6	Δ	Δ
2.5.2				Δ				Δ				
2.6												
3.0 Media												
3.1												
3.1.1				Δ	Δ							Δ
3.1.2					ΔΔ			Δ				Δ
3.2												
3.2.1							Δ		10			Δ
3.2.2			Δ	Δ	Δ	Δ	Δ			Δ		8
3.3												
3.3.1			Δ									
3.3.2		Δ										
5.0 QA												
5.1		Δ		Δ	Δ		Δ		2			
5.2	Δ	Δ										
6.0 Overview												
6.1			Δ	1	Δ			Δ			Δ	
6.2							Δ		Δ			3
7.0 SFT												
7.1					Δ		9					Δ
7.2					Δ		Δ					Δ
7.3				Δ		Δ						11

WORK BREAKDOWN STRUCTURE



November 7, 1978

FY 1979 NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS
OPERATING EXPENSE FUNDS--$$ IN THOUSANDS

TASK/SUBTASK	USGS	SANDIA	LLL	LASL	REECo	F&S	H&N	OTHER	SUB-TOTAL	TOTAL
TASK 1 SEISMIC INVESTIGATION										315
1.1 Data Processing & Analysis		115		10					125	
1.2 W/T Ground Motion Measurements		100			36	4	10		150	
1.4 Ground Motion Effects w/Depth								40 (1)	40	
TASK 2 GEOLOGICAL INVESTIGATION										2,685
2.1 Geologic Project Coordination	120								120	
2.2 Geologic Investigations	415	75		85			20		595	
2.3 Geophysics Investigations	675					15			690	
2.4 Hydrologic Investigations	360		70						430	
2.5 Tectonics, Volcanism, & Seismicity	535			75		50			660	
2.6 Geochronology	190								190	
TASK 3 MEDIA INVESTIGATIONS										1,850
3.1 Argillaceous Investigations		400			76	12	12		500	
3.2 Tuff Investigations		750		400	70	15	10	5 (2)	1,250	
3.3 Granite Investigations			100						100	
TASK 4 ENGINEERING & TECHNICAL SUPPORT										2,325
4.1 Drilling Plans & Engineering					625	150	30	20 (3)	2,090	
								1,265 (4)		
4.2 Field Geology/Core Library					75	160			235	
TASK 5 QUALITY ASSURANCE										545
5.1 Q.A. Overview		125							125	
5.2 Participant QA		70	140	150	20	20	20		420	
TASK 6 TECHNICAL OVERVIEW										650
6.1 Technical Overview Contractor		550							550	
6.2 Site Selection								100 (5)	100	
TASK 7 SPENT FUEL TEST										7,730
7.1 Experiment Design & Procurement			2,500						2,500	
7.2 Fuel Canister Engineering								1,050 (6)	1,050	
7.3 Facility Construction					3,665	180	335		4,180	
TOTAL	2,295	2,185	2,810	720	4,567	606	437	2,480		16,100

(1) Computer Sciences Corporation (2) Waterways Experiments Station (3) J. A. Blume (4) Drilling-Contractor (5) To Be Determined
(6) Westinghouse

SECTION III

MANAGEMENT STRUCTURE

DOE/NV is responsible for the overall Nevada Nuclear Waste Storage Investigations. The following is a description of the individual responsibilities of each managerial element of the Project. A chart showing the management structure is provided at the end of this section.

A. PROJECT MANAGER

The Project Manager is responsible to the Manager, NV, for overall project planning, achievement of project goals, and review of results from the Nevada Nuclear Waste Storage Investigations in accordance with the Office of Nuclear Waste Management/HQ (ONWM) project guidance and direction.

This responsibility includes:

1. Planning--Determining planned accomplishments in accordance with project guidance, the required resources, and the best methods for obtaining results. Specifically:

    a. Establishing a project management plan.

    b. Establishing project goals.

    c. Developing plans to achieve goals.

    d. Determining resources that will be required.

    e. Developing budget plans and projections to obtain the needed resources.

2. Achieving Project Goals--Guiding and motivating participants to achieve their individual objectives.

   a. Delegating responsibility and authority to participants for tasks, subtasks, and activities.

   b. Guiding participants and NV staff to achieve timely and economic completion of assigned tasks, subtasks, and activities.

3. Reviewing Results--Evaluating the degree to which objectives and milestones are achieved.

   a. Measuring progress and achievement.

   b. Developing reporting procedures for project participants.

   c. Reviewing documents for programmatic and policy content.

   d. Taking corrective action to improve performance.

   e. Reporting costs, progress, technical status, and project performance to ONWM.

B. TECHNICAL OVERVIEW CONTRACTOR

The Technical Overview Contractor is responsible to the Project Manager for providing technical guidance, advice, and assistance on overall project planning and execution (see Section V, Subtask 6.1). This responsibility includes assistance in:

1. Establishing technical objectives for the project, generating annual project guidance for work plan preparation, and identifying technical issues relating to licensing requirements.

2. Reviewing proposed work plans developed by Technical Project Officers (TPOs) to assure compatibility with project objectives.

3. Evaluating the progress of the project with respect to technical and budgetary activities and making recommendations for changes or improvements to assure compatibility and balance of the overall project.

4. Coordinating the technical activities of the Nevada Terminal Waste Storage Project with other national waste program activities.

5. Providing technical guidance to all project participants when requested and to NV for public information briefings.

6. Preparing periodic technical progress reports.

These activities will be carried out by the Technical Overview Officer and staff. The Technical Overview Officer has overall responsibility for these activities.

C. TECHNICAL PROJECT OFFICERS (TPOs)

The Technical Project Officers are responsible to the Project Manager for accomplishment of their designated tasks, subtasks, activities, and milestones of the Project. This responsibility includes:

1. Developing work plans for their designated tasks, subtasks, and activities within project guidance and Project Manager's direction.

2. Performing delegated projects in an economic and effective manner.

3. Providing the Director, NTSSO, with criteria letters requesting initiation of action by NV support contractors.

4. Providing monthly costs, progress, and technical status reports to the Project Manager.

5. Providing technical assistance to the Project Manager and Technical Overview Contractor for project and public information briefings and project planning.

D. PRINCIPAL INVESTIGATOR

Principal Investigators are responsible to TPOs for conducting the scheduled subtask activities in a timely and efficient manner. This responsibility includes:

1. Obtaining and implementing resources necessary to conduct scheduled subtask investigations.

2. Informing TPOs of subtask progress, plans for required resources, and delays or cancellation of scheduled activities.

3. Assisting the TPO in preparing work plans for subtask activities.

4. Maintaining communication will other project elements to assure coordination of all investigative activities.

E. PROJECT OFFICERS' COMMITTEE (POC)

The Project Officers' Committee consists of the Project Manager as chairman, the Technical Project Officers, the Technical Overview Officer, and the Quality Assurance Officer. The purpose of this committee is to provide the Project Manager with advice on project planning and policy considerations which may lead to decisions. The Project Officers' Committee will meet periodically as needed to assure compatibility and balance of the overall project. Items for discussion may include:

1. Project planning, budget, and policy concerns.

2. Review of progress on project tasks, subtasks, and activities.

3. Reviewing proposed work plans of all TPOs to assist DOE/NV and the Technical Overview Contractor in assuring compatibility and balance of the overall project.

F. NV STAFF SUPPORT

The NV Staff will assist the DOE Project Manager by providing reviews, recommendations, and expertise on various aspects of the project, as appropriate, in terms of their respective responsibilities.

G. PROJECT COORDINATOR

The Project Coordinators are responsible to the Project Manager for assistance with overall project planning, coordination of NV support contractor requirements with NTSSO, day-to-day monitoring and coordination of project participants, and reporting progress and performance of the project to ONWM/HQ. These responsibilities include:

1. Preparing the Project Management Plans and Cost Plans.

2. Assisting the Technical Project Officers in the development of work plans, budgets, estimates, and projections.

3. Coordinating participants' work plans with project management objectives and cost plans.

4. Reviewing Technical Project Officers' criteria letters requesting NV contractor support.

5. Providing budgetary and policy recommendations to the Project Manager.

6. Preparing monthly cost, progress, and milestone status reports and maintaining up-to-date project plans.

7. Monitoring project status and developments, identifying potential problems and providing a basis for problem solving, and recommending solutions for decision making by the Project Manager.

H. NEVADA TEST SITE SUPPORT OFFICE (NTSSO)

The Director, NTSSO, is responsible for field direction of contractor support operations, including architect-engineering, drilling, mining, construction, and logistical support for work performed at NTS. This responsibility includes:

1. Initiating action by NV support contractors based on criteria letters submitted by TPOs.

2. Providing field direction to NV support contractors on authorized work.

3. Maintaining effective communications with the Project Manager and Project Coordinators on the execution of NV support contractor work.

4. Monitoring NV support contractor progress.

5. Monitoring project status and developments, identifying potential problems and providing a basis for problem solving, and recommending solutions to the Project Manager.

I. OVERVIEW QUALITY ASSURANCE

Overview Quality Assurance is responsible for developing and managing the quality program for the Nevada Nuclear Waste Storage Investigations. Overview Quality Assurance is responsible to the Project Manager.

Overview Quality Assurance is responsible for:

1. Developing requirements for and assisting the Project Manager in administering the overall quality program.

2. Developing the Quality Assurance Program Plan.

3. Informing task-specific quality assurance organizations of the requirements for quality programs or quality procedures based on current and anticipated regulatory requirements.

4. Reviewing all project contractors' quality programs on behalf of DOE/NV.

5. Conducting audits of all project activities.

J. SITE SELECTION COMMITTEE

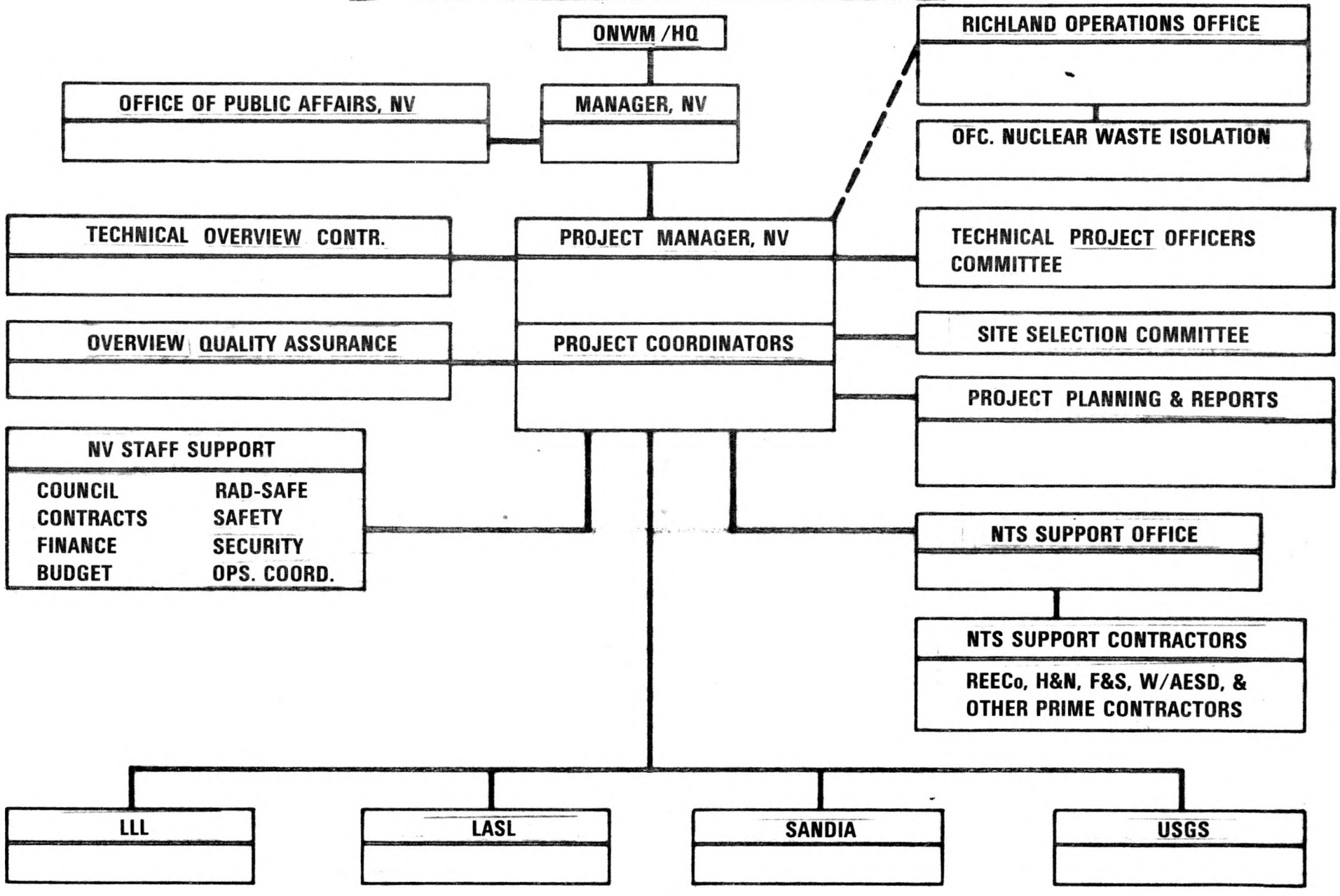
NV has the overall management responsibility for site recommendation, preparation of documentation for license application, and operation of a DOE waste repository if sited in southern Nevada. NV will assume the lead in organizing the Site Selection Committee (see Section V., Subtask 6.2) and guiding it towards its objective:

1. To develop procedures and criteria for selection of radioactive waste disposal sites; and

2. To use these procedures and criteria to evaluate potential sites on the NTS and adjacent areas.

ORGANIZATION CHART

NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS



SECTION IV

TECHNICAL APPROACH

The NTS is of interest for terminal storage of radioactive waste for three principal reasons:

-- It has several potentially suitable geologic environments with eventual groundwater discharge in hydrologically closed desert basins.

-- It is controlled by the Federal Government and already requires long-term monitoring and administrative control.

-- There exists a strong base of logistical support.

In spite of these favorable characteristics, DOE/NV cannot move ahead vigorously with this added mission until several major issues are resolved:

-- Is the geological isolation of radioactive wastes compatible with the NTS prime mission of nuclear weapons testing?

-- Is the NTS geologically stable enough to allow prediction of waste isolation for the required period of time?

-- Are the geologic units at the NTS of sufficient extent and quality to be suitable for waste isolation?

The current focus of the Nevada Nuclear Waste Storage Investigations is to resolve these basic issues and to determine whether suitable sites exist on the NTS for establishment of a licensed commercial waste repository. If unfavorable results are obtained for areas on the NTS, it is the intent of the project to determine whether suitable areas exist in the southern four counties of Nevada which could be used for deep geologic disposal of nuclear wastes.

In this section, the programmatic approach is summarized by listing a series of critical questions in each study area which must be answered before the above issues will be resolved. The technical work plans designed to address these questions are described in Section V.

A. SEISMIC INVESTIGATIONS

The basic technical question regarding the compatibility of geologic waste isolation and weapons testing at the NTS is whether a repository could withstand ground shocks produced by underground nuclear explosions. With regard to natural seismicity, the NTS lies within Seismic Zone 2 and close to the boundary of Zone 3. Important questions addressing weapons-produced and natural seismicity arise:

-- What will be the frequency and amplitude of ground motion resulting from future weapons tests and natural seismic events at candidate repository sites?

-- What is the capability for predicting ground motion at candidate sites?

-- What is statistical uncertainty in the predictions?

-- Do anomalies occur which would yield ground motions substantially different than those predicted?

-- To what degree is ground motion attenuated at depths considered for repositories?

B. GEOLOGICAL INVESTIGATIONS

The issue of geological suitability of natural environments for waste isolation is complex. NTS environments raise special questions, especially regarding the potential effects of continued, long-term tectonic activity. Among the most important tectonic questions are:

-- What is the degree and distribution of faulting?

-- Are the active fault zones migrating and if so, in what direction and at what rate?

-- What are the potential for and the effects of renewed volcanism and igneous intrusions within and near the NTS?

-- What rates of uplift or subsidence can be anticipated, and what erosional or depositional consequence will result?

-- What is the degree of fracturing and alteration within candidate rocks at depths as great as 5,000 feet?

-- What is the volcanic and seismic potential along ancient zones of weakness which were apparently responsible for local intrusive stocks?

In addition to these tectonic questions, it is necessary to address the long-term questions of potential radionuclide transport in the groundwater system of the NTS and its environs. Questions to be addressed here are:

-- What are the present pathways for groundwater movement?

-- What will be the likely groundwater pathways if climatic conditions change?

-- What concentrations of radionuclides are likely along potential flow paths from the repository?

-- How long will it take for initial and peak concentrations of radionuclides to appear at discharge points?

-- How are these concentrations likely to be changed at groundwater discharge points?

-- Do hydraulic heads increase with depth such that future discharge to surface might occur directly above or within short distances from a repository?

-- What effects do fault zones and movements have on groundwater movement?

C. MEDIA INVESTIGATIONS

The primary media available for repository use at the NTS include granite, argillite, and tuff. Uncertainty exists regarding the suitability of these media, and additional investigation and testing will be required before a repository can be designed with confidence in any medium. The following questions are critical:

-- Will the host medium sufficiently withstand the short-term and long-term effects of thermal loading produced during a repository's history; what mechanical stresses will be induced by thermal loading and construction activities; and can the host medium withstand these stresses?

-- What extent of an individual medium or combination thereof is required for effective containment of radionuclides and what are the special requirements for a continuous mass of a relatively homogenous host medium, given various facility designs?

-- Will the physical properties of the media be adversely affected by the thermal and radioactive load imposed by nuclear wastes?

-- What are the hydrologic properties, including porosity, permeability, and water content, of the media and how do those hydrologic properties affect the containment potential of the media?

-- What are the radionuclide sorption-desorption properties of the media?

The technical questions listed above are applicable to all candidate exploration areas and media of the NTS and surrounding regions. As a result of weapons testing compatibility decisions, FY 1979 exploration efforts are restricted to the southwestern portion of the NTS. Present exploration effort is concentrated at Yucca Mountain (a tuff environment) and in the Calico Hills area (an argillite and potential granite environment). As programmatic decisions are made regarding the technical merits of specific areas, emphasis or de-emphasis of project resources may occur. FY 1979 media studies will concentrate resources on tuff and argillite. Analysis of selected samples from 2,500 feet of core obtained during FY 1978 at each of two holes, one each in tuff and argillite, will comprise a large portion of this year's media studies. Granite studies are primarily associated with the Climax Stock Spent Fuel Test; hence, major emphasis is shifted from the study of media characteristics and responses to the design and implementation of test facilities. Questions more specifically concerned with particular exploration areas or individual media are addressed in the work plans of Section V.

SECTION V

SUBTASK WORK PLANS
NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS

A. SUBTASK 1.1 DATA PROCESSING AND ANALYSIS

Objective of Subtask

1.1 Data Processing and Analysis--The objective of this subtask is to define the ground motion environment from nuclear explosions as a function of yield and distance and at specific candidate storage sites; to determine experimentally how ground motion changes with depth below the surface.

Descriptive Summary

SL--A waste repository located on or near NTS will be subjected to ground motion from the ongoing weapons test program. The magnitude of the motions will be dependent upon the location of a repository with respect to weapons test areas. If the facility is sufficiently close to test areas, it will have to be designed to withstand the motions. At slightly greater distances, it will be necessary to know the motions in order to establish safe operating procedures at the time of tests. And last, it will be necessary to develop a ground motion prediction method sufficient to satisfy the NRC requirements for licensing.

The only equations available for predicting ground motion for underground tests conducted at NTS were the ERC equations. These equations are a set of empirical equations which were developed to predict the ground motions at large distances from the test site (i.e., Las Vegas). The use of these equations imposed overly restrictive results for potential waste sites within the boundaries of the NTS. In FY 1978, development was

begun on a new set of ground motion equations based on analysis of measurements made on the NTS for a limited range of yields. These equations developed to date show a significant reduction in predicted acceleration at potential waste storage sites by analysis of the more applicable data set (i.e., for a 99 percent level of confidence (3σ), the predicted distance associated with a given test yield (700 kt) and peak ground motion acceleration (0.7 g) is about 50 percent of the corresponding ERC distance prediction). During FY 1978, acceleration data were processed for only about 58 percent of the available measurements and velocity and displacement data for about half of that. Therefore, the task for FY 1979 is to improve the equations in their present form by analysis of the additional data and to include the analysis of the ground motion data measured at depth. The additional analysis is needed to provide a better statistical basis for the equations and help determine how much analysis is necessary before the equation can be considered invariant for predictions on NTS.

The result of the analysis will be empirical equations for predicting ground motion from underground nuclear detonations as a function of explosion energy and distance from the explosion. These equations, together with their standard deviations, will be used in facility design and in licensing evaluations.

LASL--Will provide data on past nuclear events from their ground motion data bank as the need is determined by the Test Program/Waste Isolation Group.

Interface Plans

Interfaces with other subtasks:

1.2 Weapons Test Ground Motion Data Acquisition--SL will make the measurements which will provide new data for Subtask 1.1. The Principal Investigator of Subtask 1.1, Data Processing and Analysis, is responsible for this interaction.

1.4 Effect of Depth on Ground Motion--A continuing flow of ground motion data will be provided Subtask 1.4. The Principal Investigator of Subtask 1.1 is responsible for this interaction.

2.5 Tectonics, Seismicity, and Volcanism--Liaison will be maintained to facilitate colocation, both at the surface and downhole, of some of the weapons test ground motion measurement stations with those for measurement of natural earthquake motions. Techniques of data processing will be discussed to be certain the data are as comparable as possible. The Principal Investigator of Subtask 1.1, Data Processing and Analysis, is responsible for this interaction.

6.1 Sandia Technical Overview--The Sandia Overview Manager will advise of any changes in the Terminal Waste Storage Project which may change the emphasis on data analysis, or which may change emphasis on the locations from which data are obtained for analysis.

Test Program/Waste Isolation Working Group--Progress of the subtask will be monitored periodically by the Test Program/Waste Isolation Working Group which will provide guidance with regard to the nuclear events which are to be a part of the data set.

B. SUBTASK 1.2 WEAPONS TEST GROUND MOTION MEASUREMENTS

Objective of Subtask:

1.2 Weapons Test Ground Motion Measurements--The objective of this subtask is to make ground motion measurements at specified locations to provide the basis for determining how weapons-test-induced ground motion changes with depth, distance, and yield to determine for candidate sites whether or not there is site-specific ground motion amplification.

Descriptive Summary

SL--The data acquired under this subtask is acquired on analog tape, is subsequently digitized and feeds directly into Subtask 1.1. It, therefore, has the same applicability to the test program as Subtask 1.1. Measurements are made at locations which are agreed upon with project officers as contributing to the objectives of the project. The attached table shows the past, current, and planned location of measurement stations.

REECo will provide support services for reconditioning and installation of seismic measuring equipment.

F&S will provide technical engineering support services associated with the above drilling requirements.

H&N will provide technical engineering support services such as surveying associated with this subtask.

Interface Plans

Interfaces with other subtasks:

1.1 Data Processing and Analysis--A continuing flow of ground motion data will be provided to Subtask 1.2 by Subtask 1.1. The Principal Investigator for Subtask 1.1, Data Processing and Analysis, is responsible for this interaction.

2.6 Tectonics, Seismicity, and Volcanism--Liaison will be maintained to facilitate colocation, both at the surface and downhole, of some of the weapons test ground motion measurement stations with those for measurement of natural earthquake motions. The Principal Investigator of Subtask 1.2, Weapons Test Ground Motion Measurements, is responsible for this interaction.

6.1 Technical Overview Contractor--The Technical Overview Contractor will advise of any changes in the Nevada Nuclear Waste Storage Investigations which may change the emphasis on the locations from which data are obtained for analysis. The Technical Overview Contractor for Subtask 6.1 is responsible for this interaction.

C. SUBTASK 1.4 EFFECT OF DEPTH ON GROUND MOTION

Objective of Subtask

1.4 Effect of Depth on Ground Motion--The objective of this subtask is the prediction of subsurface ground motion necessary for the seismic design of underground waste storage facilities when provided with the surface ground motion parameters and the necessary geological and physical description of the proposed site.

Description Summary

CSC--Will develop a methodology or procedure for estimating the subsurface ground motion produced by seismic events, especially underground nuclear explosions, based upon known or predicted surface motions and the physical and mechanical properties of the site geology. This will be accomplished in several stages:

1. Develop a suitable mathematical model or models of idealized subsurface geology and the physical mechanisms necessary to transform a specified surface ground motion into a quantitative estimate of the peak parameters of that motion at depth. Results will be reviewed prior to proceeding with specific application to the NTS. An interim report will be issued for this review in January 1979 (Milestone 1).

2. Depending upon availability of ground motion data to be provided by others, test and refine the model or models using specific NTS ground motion data and specific subsurface physical and mechanical properties of the site geology.

3. Define and document in a final report the resulting methodology or procedure for predicting the amplitude and spectral composition (and the associated uncertainty) of ground motion expected at subsurface sites at the NTS from various seismic events. This final report will be issued in May 1979 (Milestone 2). The report will include

recommendations for further study or possible enlargement of the scope of the study to include complete prediction studies based on source strength, travel path, and prediction of both surface and underground seismic parameters.

In addition to the two interim reports and the final report as identified above, the Contractor will provide the NV Contracting Officer and Sandia Laboratories, Albuquerque, New Mexico, with a monthly status letter-report for the term of this research study.

Data presentation suitable for Subtask 1.4 will be provided. This may include time histories, response spectra, comparisons of predicted and measured ground motion at some of the locations under investigation in Subtasks 1.1 and 1.2, and data concerning ground motion variations with depth.

Interface Plans

Interfaces with other subtasks:

1.1 Data Processing and Analysis--A continuing flow of ground motion data will be provided to Subtask 1.4 by Subtask 1.1. The Principal Investigator for Subtask 1.1, Data Processing and Analysis, is responsible for this interaction.

1.2 Seismic Investigations; Weapons Test Ground Motion Measurements--Discussions shall take place between 1.4 participants and participants in the indicated subtask, in order to have available the most current data on ground motion measurements, and in order to have these data in the form required by the activities of Subtask 1.4. The Principal Investigator for 1.4 is responsible for this interaction.

2.5 Tectonics, Seismicity, and Volcanism--Liaison will be maintained to facilitate colocation, both at the surface and downhole, of some of the weapons test ground motion measurement stations with those for measurement

of natural earthquake motions. Techniques of data processing will be discussed to be certain the data are as comparable as possible. The Principal Investigator of Subtask 1.4 is responsible for this interaction.

6.1 Technical Overview Contractor--The Technical Overview Contractor will advise of any changes in the Nevada Nuclear Waste Storage Investigations which may change the emphasis on data analysis, or which may change emphasis on the locations from which data are obtained for analysis.

D. SUBTASK 2.1 GEOLOGIC PROJECT COORDINATION

Objective of Subtask

2.1 Geologic Project Coordination--The objectives of this subtask are: (1) to provide continuous coordination of investigations conducted under other Task 2 subtasks, so as to ensure an effective interdisciplinary approach to repository exploration and evaluation; and (2) to assure that Task 2 subtasks interface as necessary with NV in terms of planning, operations, and technical and financial reporting.

Descriptive Summary

USGS will coordinate the technical investigations of all organizations participating in Task 2 studies in order to assure that each subtask obtains the maximum benefit from the data and interpretations generated by other subtasks. As the subtasks are defined generally in accordance with the organizational structure of the USGS, it will also be the responsibility of Subtask 2.1 to compile and integrate the results in terms that are of importance to NV and other project participants. This will be accomplished by compiling for periodic reports and reviews the technical highlights, overall progress, and major interfaces applicable to specific areas and media being investigated both on and off the NTS.

Interface Plans

The fundamental objectives of this subtask are to ensure that all interfaces necessary for interdisciplinary investigations of geologic and hydrologic problems take place in a timely and effective manner. Consequently, this subtask will interface continuously with all Task 2 subtasks. In addition, it will assure that necessary and desirable communications are maintained with the following:

Task 1, Seismic Investigations: To assure the colocation of seismic measurement stations in order to compare the ground motion characteristics

of natural and weapons test-induced seismicity; and to provide geologic data necessary to calculations of frequency-response spectra near potentially active faults.

Task 3, Media Investigations: To assure that materials-property data are exchanged to the benefit of all participants; and to provide geologic, geophysical, and hydrologic data to the extent possible in format useful for thermomechanical modeling.

Task 4, Engineering and Technical Support: To participate in the formulation of drilling criteria and preparation of work orders and/or invitations for bids, including modifications to specifications; to obtain needed assistance in engineering and construction; and to technically train and direct the activities of the cadre of F&S geologists. Specifically, the Subtask 2.1 Principal Investigator will, in consultation with project participants, determine the priorities of objectives to be met by drilling and subsurface testing and will develop commensurate criteria that will meet the highest-priority needs while accommodating lower-priority needs as possible.

Task 5, Quality Assurance: To assure that Task 2 subtasks cooperate in the formulation and application of quality assurance plans and quality control procedures.

Task 6, Technical Overview: To coordinate planning, reporting, and participation in project reviews and other technical project meetings by Task 2 investigators as appropriate.

E. SUBTASK 2.2 GEOLOGIC INVESTIGATIONS

Objectives of Subtask and Activities

2.2 Geologic Investigations--The objective of this subtask is to locate and characterize the most suitable rock masses (granite, shale/argillite, and tuff) for storage of high-level radioactive waste on the Nevada Test Site and in southern Nevada.

2.2.1 Shale/Argillite--The objectives of this activity are: (1) to conclude and summarize the geologic evaluation of the Syncline Ridge area, (2) to determine if masses of Eleana argillite with suitable properties and dimensions to accommodate a waste repository occur in the subsurface near Calico Hills, and (3) to continue preliminary evaluations of shale/argillite rocks in southern Nevada.

2.2.2 Tuff--The objectives of this activity are: (1) to determine the structural and stratigraphic configuration of the Yucca Mountain area and (2) to identify potential masses of tuff in southern Nevada.

2.2.3 Granite Rocks--The objectives of this activity are: (1) to determine the structural and emplacement configuration of the Wahmonie intrusive stock, (2) to determine if Calico Hills is underlain by an intrusive rock with suitable properties and dimensions to accommodate a waste repository, (3) to complete the geologic assessment of the Twinridge granitic stock, and (4) to recommend potential granitic masses in southern Nevada for consideration as repository sites.

Descriptive Summary

2.2.1 Shale/Argillite--USGS will complete investigations of the Syncline Ridge area (central and northern structural blocks) and issue a draft report on the geologic evaluation of the Syncline Ridge area.

The USGS will complete field mapping of the Calico Hills/Topopah Wash areas in an attempt to evaluate the surface distribution of the Eleana Formation.

The USGS and Sandia Laboratories will continue to assess possible areas for repositories in shale/argillite in southern Nevada. This will be accomplished by geologic field investigations of areas described in the inventory of clay-rich rocks in Nevada. These studies will be limited to subjective, qualitative evaluation of the general field characteristics and lithologic descriptions of argillaceous rocks. A list of shale/argillite sites with greatest potential for emplacement of radioactive waste will be compiled. Additional geologic, hydrologic, and geophysical studies will be recommended for the selected sites.

2.2.2 Tuff--USGS, Sandia Laboratories, and LASL will assemble and evaluate data acquired from FY 78 drilling of the Yucca Mountain exploratory drill hole (UE25a#1) and make recommendations about whether to proceed to greater depths (2,500 feet) and whether additional data are needed to better define the stratigraphy and structure of the Yucca Mountain area. A draft report will be issued summarizing the stratigraphy and structure encountered in the Yucca Mountain exploration drill hole UE25a#1. Geologic field studies in the vicinity of Yucca Mountain will continue to evaluate the relationship between surface and subsurface features.

Assistance will be provided to Subtask 2.3 in interpretation of geophysical data from the Timber Mountain area and in preparation of draft report on Timber Mountain to be issued in mid-FY 79.

Concurrent with the above activities, low-level effort will be applied to evaluate tuff deposits throughout southern Nevada. This includes: (1) completion of the inventory of tuffs in southern Nevada; (2) preliminary geologic mapping of areas that have potential for a waste repository; (3) sampling of rocks from those areas for laboratory analyses of thermal, mechanical, and material properties; and (4) preliminary assessment of potential tuff areas worthy of further investigations. This work will be closely coordinated with Subtasks 2.3, 2.4, and 2.5.

2.2.3 Granitic Rocks--The USGS will complete a detailed geologic field investigation of the Wahmonie granitic stock. Work entails geologic mapping, collection of samples for age dating, and physical properties. This work will be closely coordinated with Subtask 2.3.

The USGS and Sandia Laboratories will assemble and evaluate data acquired from FY 78 and FY 79 drilling of the Calico Hills exploratory drill hole (UE25a#3) and from field mapping, and will make recommendations about whether to proceed with further exploration. The data to be evaluated consist of thermal, mechanical, and material properties of drill core; frequency and nature of faults and fractures in the core; and physical characteristics of the rock in the area. A draft report on the geology of the UE25a#3 drill hole will be issued.

The USGS will summarize and issue a draft report on existing geologic and geophysical data on the Twinridge granitic stock.

Concurrent with the above activities, the USGS and LASL will recommend potential areas in southern Nevada for consideration as repository sites, based on information documented in the preliminary inventory of granitic masses report and from field data obtained in the FY 78 field reconnaissance. The detailed field investigations will include geologic mapping to evaluate the character of the granite masses such as lateral and vertical distribution, lithology, and structural discontinuities within the granite.

Interface Plans

Interfaces with other subtasks:

2.3 Geophysical Investigations--Subtask 2.2 will work closely with Subtask 2.3 on application of geophysical methods designed to delineate the subsurface geometry of study areas on the NTS and in southern Nevada.

2.4 Hydrologic Investigations--Subtask 2.2 will work closely with Subtask 2.4 in defining the hydrologic setting of all areas in southern Nevada under consideration for waste disposal.

2.5 Tectonics, Seismicity, and Volcanism--Subtask 2.2 will provide information to Subtask 2.5 to help characterize the tectonics, seismicity, and volcanism of the potential candidate sites.

2.6 Geochronology--Subtask 2.2 will provide samples to Subtask 2.6 for radiometric dating of the various media under investigation and call upon this subtask for assistance in interpretive dating of tectonic and geomorphic features.

3.1 Argillite Investigations--Subtask 2.2 will interface with Subtask 3.1 to help develop the thermal, mechanical, and chemical data necessary to characterize media at potential candidate sites.

3.2 Tuff Media Investigations--Subtask 2.2 will interface with Subtask 3.1 to help develop the thermal, mechanical, and chemical data necessary to characterize media at potential candidate sites.

4.2 Field Geologic Support--Subtask 2.2 will obtain support from Subtask 4.2 in drill hole monitoring, logging of samples, and geologic field investigations.

F. SUBTASK 2.3 GEOPHYSICAL INVESTIGATIONS

Objectives of Subtask and Activities

2.3 Geophysical Investigations--The objective of this subtask is to determine the subsurface distribution of physical properties at potential repository sites on and near the NTS.

2.3.1 Regional and Site Investigations--These activities individually address, respectively, argillite, tuff, and granite exploration areas and have three objectives: (1) to identify by airborne and surface geophysical methods potential repository sites where a mass of suitable rock may exist, and to recommend these candidate sites for detailed exploration; (2) to determine the size, shape, depth of burial, structural integrity, and geologic setting of specific candidate sites by geophysical techniques; and (3) to identify regional structural features which might influence groundwater movement.

2.3.2 Tectonic Support Studies--The objective of this activity is to provide information about the Earth's subsurface that will aid in locating major faults and assessing the potential for future volcanism.

2.3.3 Borehole Geophysics--The objective of this activity is to refine in-hole, hole-to-surface, and hole-to-hole geophysical techniques in order to characterize potential subsurface repository environments in greater detail than is possible by surface measurement and drilling.

Descriptive Summary

Geophysical techniques provide a means of obtaining information about the Earth's subsurface without resorting to extensive drilling. Hence, they provide a nondestructive method of investigating the physical character of potential repository environments at depths of interest.

2.3.1 Regional and Site Investigations--USGS will concentrate geophysical investigations of the three principal rock media which include:

Shale/Argillite--Principal area of interest of this study is the Calico Hills/Topopah Wash areas. A comprehensive suite of surface geophysical studies will be performed, similar to those applied in FY 1978 to the Syncline Ridge area. There are two potential repository media at the site--a buried intrusive body and overlying Eleana argillite. Geophysical investigations will attempt to define the size and shape of the upper surface of the presumed intrusive, the extent of faulting and fracturing within the intrusive and the surrounding rocks, and the extent of hydrothermal alteration in the intrusive and adjacent rocks. Activity objectives will be accomplished by: (1) evaluation of data from new aeromagnetic and surface magnetic surveys; (2) determination of magnetic properties from collected rock samples to determine the nature and extent of highly magnetic units which occur in the Eleana argillite and obscure the magnetic-signature of any buried intrusive; (3) a detailed gravity survey to help identify the gross shape of the intrusive, fault locations, and density variations within the argillite; and (4) galvanic and electromagnetic electrical surveys to improve understanding of fault geometries and locations and to help map the interface between argillite and intrusive. A variety of electrical techniques will be used because each provides discrete information for a limited range of exploration depths and lateral discontinuities. A seismic refraction survey is also planned to aid in identifying faults beneath alluvium and in determining formation seismic velocities.

Tuff--Principal area of investigation will be Yucca Mountain and studies will be similar to those of the Calico Hills/Topopah Wash areas. Semiregional gravity and ground magnetics and electrical studies will be performed in order to investigate the major faults and gross details of the bedrock structure in the Yucca Mountain area. An audio-magneto-telluric (AMT) survey will be contracted to provide a semiregional evaluation of the geoelectrical section to depths of a kilometer or more.

Granite--Existing aeromagnetic and regional gravity data will be supplemented as required to aid Subtask 2.2 in the identification of alternate granite, tuff, and argillite sites on the NTS and in southern Nevada. One granite site will be selected in coordination with Subtask 2.2 and surveyed with AMT, perhaps the most cost-effective means of providing semiregional electrical information for screening of potential repository sites. Refinement of interpretations and completion of the documentation report on Timber Mountain will extend into FY 1979.

2.3.2 Tectonic Support Studies--Several studies are planned which directly support Subtask 2.5 (Tectonics, Seismicity and Volcanism). Prior magneto-telluric work has identified several areas on the NTS with a very low resistivity zone of significant depth and thickness. These areas suggest high geothermal gradients and possibly partially molten rock at relatively shallow depths, perhaps as shallow as 5 km. To define better the areal extent, and significance for potential volcanism of the poor conductor, additional magneto-telluric data will be collected in the southwestern part of the NTS and nearby regions and geophysical analysis of the depth to the curie isotherm will be performed. Seismic refraction, gravity, galvanic resistivity and telluric work will be performed in the Jackass Flats area to better define near-surface fault systems.

2.3.3 Borehole Geophysics--USGS will conduct borehole operations in two distinct phases--geophysical logging and hole-to-surface and/or hole-to-hole investigations at exploratory drill holes defined in coordination with other project participants. Electrical, sonic, caliper, radiometric, and magnetic logs will be completed by USGS and/or a NV contractor for the entire depth of exploratory holes in order to provide data on the near-field environment for modeling and calibration of hole-to-surface and hole-to-hole experiments. Initial work in FY 1979 will consist of completing necessary logging at the Yucca Mountain and Calico Hills drill sites and performing hole-to-surface measurements to the extent that downhole conditions allow.

All new exploratory holes will be logged upon completion (or at intermediate depths as drilling conditions dictate) and then utilized for intensive hole-to-surface and, if suitably located, hole-to-hole D.C. resistivity, electromagnetic, and seismic measurements. An important part of these experiments will be to assess the state-of-the-art techniques and to define the limiting hole-to-hole distances for borehole methods. To support the borehole work, a limited number of physical property measurements will be made on selected core samples from the holes.

Interface Plans

Interfaces with other tasks and subtasks:

2.2 Geologic Investigations--Geophysical data and interpretations generated by Subtask 2.3 will greatly influence and be influenced by interpretations of subsurface geologic conditions. Hence, final interpretations of geophysical data will involve coordination with Subtask 2.2.

2.4 Hydrologic Investigations--Several geophysical techniques to be employed will provide site-specific information that is helpful for determining water content, water quality, and permeability. Hence, substantial coordination with Subtask 2.4 is anticipated.

2.5 Tectonics, Seismicity, and Volcanism--Geophysical investigations will provide information about faults, structural or mineralogic features, and the depth to the curie isotherm that will be of use in tectonic interpretations.

Task 3, Media Investigations--Physical properties determined from laboratory testing of core samples will be closely coordinated with Task 3 in order to prevent unnecessary duplication of effort and to provide sufficient cross-checks to assure reliability of data. USGS has Subtask 2.3 responsibility for this interface.

Task 4, NTS Engineering and Technical Support--Subtask 2.3 will draw operational assistance and support as necessary from NV, NTSSO, and the Subtask 4.2 F&S geologic staff.

Coordination with Task 4 on environmental and safety constraints will be required for USGS and contractor seismic operations that require the use of explosives. In addition, some seismic work will require the use of a backhoe for emplacement of explosives. Approximately 12 days of use of a large-wheeled backhoe are planned. Eight drill holes, 60 feet deep and 8 inches in diameter, are also required. USGS has Subtask 2.2 responsibility for this interface.

Activity 2.3.3, Borehole Geophysics, will actively participate in the planning, development of criteria, scheduling, and field operations for drilling, logging, and completion of exploratory holes.

Interfaces within this subtask:

The airborne, surface, and borehole geophysical methods are complementary and interpreted together in an interactive fashion to diminish ambiguities. Close and continuous coordination will be maintained among all Subtask 2.3 investigators.

G. SUBTASK 2.4 HYDROLOGIC INVESTIGATIONS

Objectives of Subtask and Activities

2.4 Hydrologic Investigations--The objective of this subtask is to determine the present and past hydrologic regimes of the Nevada Test Site and surrounding area in order to predict the potential for hydrologic transport of wastes to the biosphere.

2.4.1 Regional Hydrology--The objectives of this activity are to assemble data on the regional hydrology of southern Nevada, to define the regional hydrology of candidate repository sites off the Nevada Test Site, and to characterize the hydrogeology of pathways from such candidate sites to points of present and possible future discharge.

2.4.2 Hydrology of NTS Areas--The objective of this activity is to define in detail the local hydrology of candidate repository sites at or contiguous to the Nevada Test Site, including their relationship to regional systems.

2.4.3 Paleohydrology--Because of the probability of climatic changes in time frames of tens of thousands of years, hydrologic systems are expected to differ from those today. The objective of the Paleohydrology activity is to define water table depths, gradients, and pathways to points of groundwater discharge during Pleistocene pluvial cycles in southern Nevada.

2.4.4 Solute-Transport Model--The objective of this activity is the development of a digital hydraulic and solute-transport model to predict rates and directions of movement of radioactive species and their concentrations in groundwater if they should be released from a waste repository in the vicinity of Nevada Test Site.

2.4.5 Short-Term Hydraulic Effects--The presence of a mined underground opening and the thermal loading of a repository will drastically change the local hydrologic regime from its undisturbed condition. The FY 1979 objective of this activity is to develop a digital model to describe pore-fluid pressures generated in rock containing a heat source. The ultimate objective of the investigation is to model the multiphase hydrodynamic history of a repository during the construction, operational, and thermal-pulse stages.

2.4.6 Permeability Studies--The objective of this activity is to determine permeability characteristics of several rock types under consideration as repository media when they are subjected to various laboratory conditions of temperature and confining pressure.

Descriptive Summary

2.4.1 Regional Hydrology--Characterization of the hydrologic systems of southern Nevada will be required in support of an application to construct a waste repository at the NTS or nearby areas. In addition, the possibility exists that a suitable site for a repository will not be identified at NTS. Therefore, exploration to identify alternative sites in southern Nevada is being conducted in parallel with, but less intensively than, exploration for sites at or contiguous to NTS.

During FY 1979, the USGS will:

1. Conduct investigations of the most favorable granite, shale, and tuff sites in southern Nevada. Investigations will include an assessment of the probable water table occurrence, the probable gross permeability of the candidate masses and enclosing rocks, and the relationship of the local hydrology to the regional systems. Water levels, spring discharges, and stream base flow will be characterized as occurrences allow.

2. Sample the regional groundwater systems for age determination by the methods of carbon-14, uranium ratios, uranium-thorium, and uranium-thorium-helium.

3. Design future drilling programs for sampling and testing to confirm hydrologic regimes near candidate sites.

2.4.2 Hydrology of NTS Areas--During FY 1979, the maximum effort will be applied to evaluating areas of the Nevada Test Site. Although the early stages of this evaluation emphasize geology and geophysics, drill holes completed in FY 1978 and FY 1979 will be available to initiate site-specific hydrologic studies.

USGS will monitor fluid levels in existing drill holes to determine static water levels and trends of these levels with time; these measurements will be constrained by the method of drill hole completion and by the residual drilling fluids. Upon completion of larger-diameter holes and geophysical measurements in them, tests utilizing inflatable packers will be performed to determine the distribution of head, permeability, and water quality with depth. Specialized logging techniques, such as tracejector and salinometer surveys and temperature logging, will be applied to determine directions of head change and depths and lithologies of permeable zones.

2.4.3 Paleohydrology--Transport of nuclides away from a repository by groundwater to some degree is generally accepted as the most probable pathway to the biosphere. As repository-siting criteria under development require that transport times be as long as possible, the time frame of interest is in the tens of thousands of years at least. During the Pleistocene (glacial) Epoch, several worldwide changes in climate occurred within similar intervals, and future climatic changes are probable. In order to assess the differences between present hydrologic systems and those that will occur under future wetter climates, it is necessary to define the systems that existed under pluvial climates of the past.

During FY 1978, the USGS initiated a search for evidence of groundwater discharge in southwestern NTS and in areas downgradient from NTS. To date, three occurrences have been found in the search area that have sufficiently dense deposits of travertine to be dated by U-Th techniques. This search will be continued during FY 1979 in order to provide complete documentation of the lack of evidence for such discharge (if this should prove to be the case) or to find occurrences not identified earlier.

An alternative means of defining maximum past altitudes of the water table is to identify mineralogic evidence of submergence above the present water table. The USGS will examine mineral assemblages of subsurface samples from existing drill holes to determine if mineralogic variations suggest former higher water tables. If existing samples prove inadequate for this purpose, a drill hole to a depth of approximately 800 feet will probably be required.

A method of elucidating past climatic conditions is the analysis of ancient and recent pack rat middens. Identification of seeds and other plant debris in the middens can yield important information about the plant assemblages in the area, and thus the climatic conditions under which the plants grew. Radiocarbon dating of the materials can determine the age of these assemblages and time span of the climatic period. The USGS will collect groups of midden samples from low, intermediate, and high elevations, respectively. These samples will be examined and plant types will be classified taxonomically. Pertinent parts of the samples will be radiocarbon dated. Further work in FY 1980 will relate these findings into a paleoclimatic scenario.

2.4.4 Solute-Transport Model--Quantitative prediction of the rates of movement and time- and distance-dependent concentrations of various radioactive species will ultimately be essential to support a license application.

The USGS in FY 1978 initiated the development of a digital solute-transport model of a large area encompassing NTS. Work elements planned for FY 1979 are:

1. Refine the 2-D hydraulic model of the area, i.e., the regional flow model, until a satisfactory match is found between computer-generated potentials and naturally occurring measured potentials.

2. Using the hydraulic data and parameters of paragraph 1., run solute-transport simulations with state-of-the-art distribution coefficient values.

3. Complete draft report on the regional two-dimensional solute-transport model.

4. Begin development of a local repository model with transport for a site-specific situation (dependent upon location chosen).

2.4.5 Short-Term Hydraulic Effects--Thermal loads in rocks containing significant amounts of water can be expected to produce increased pore-fluid pressures. In the most intense part of the thermal field, steam may be produced, causing large pressure increases even in partly saturated rocks. Where rock permeability is low, the increase in pore-fluid pressures may seriously decrease bulk rock strength by hydraulic or steam fracturing.

The USGS will initiate development of a model to describe the hydrodynamic effects of thermal loading in water-bearing rocks. During FY 1979, effort will be concentrated on duplicating the results of measurements made by USGS in the Climax Stock during the LLL Heater Test No. 1. As the scale of this test was small, the presence of the hole in which pressure was measured constituted a major perturbation (pressure sink) in the experiment. The fact that pressures were measured greater than can be explained by heating of the fluid in the measurement hole indicates

that intercrystalline or microfracture permeability was sufficient for fluid migration. The initial two-dimensional model will consider the following parameters and factors: the transient thermal field as defined by LLL, associated volumetric changes of the rock matrix and of the contained water and air, the rock porosity and degree of saturation, and the rock permeability. For a test of this scale and duration, it will be assumed initially that the unconfined heater hole H2 and the tunnel floor were the only constant-pressure boundaries.

2.4.6 Permeability Studies--LLL will construct multiple apparatus for the laboratory measurement of permeability in various rock types in FY 1979. They will design, construct, and place into operation a unit capable of measuring permeabilities of 10^{-5} to 10^{-11} D (water) under hydrostatic pressures of up to 100 MPa, pore fluid pressures up to 100 MPa, and temperatures of 25^{o} C. only. Two pressure vessels, each capable of 3-5 NX (5.3-cm diameter) samples or two 10-cm diameter samples will be included. Test control and data acquisition will be possible by either manual means or by automatic means using an LSI-11 minicomputer. In FY 1980, they will add a temperature capability (up to 500^{o} C.) to the above units.

Interface Plans

Interfaces with other substasks and activities:

2.2 Geologic Investigations--Activity 2.4.1 Contributing Investigator will work closely with geologic investigations of off-NTS areas and will collaborate on reports concerning these areas. Activity 2.4.2 Contributing Investigator will participate in subsurface investigations that will be conducted primarily for geologic purposes in FY 1979. Activity 2.4.4 Contributing Investigators will obtain assistance for Subtask 2.2 in defining stratigraphic and structural features for use in estimating hydraulic parameters. Activity 2.4.5 Contributing Investigators will consult with geologic investigators concerning the properties of the Climax Stock granite.

2.3 Geophysical Investigation--Activities 2.4.1, 2.4.2, and 2.4.4 Contributing Investigators will participate in the design and will obtain data from the results of geophysical investigations.

2.5 Tectonics, Seismicity, and Volcanism--The intensive field study of structural features in the NTS may result in identification of travertine deposits, calcite vein fillings, etc., that are of significance to the Activity 2.4.3 (Paleohydrology) investigations; close liaison will be maintained.

2.6 Geochronology--Subtask 2.6 personnel will participate directly in designing sampling patterns and techniques for obtaining age dates in Activities 2.4.1 and 2.4.3.

3.1 Argillaceous Experiments--Activity 2.4.4 Contributing Investigators will receive data and consultive advice from Subtask 3.1 in the physical and sorptive properties of argillite.

3.2 Tuff Experiments--Activity 2.4.4 Contributing Investigators will receive data and consultive advice from Subtask 3.2 in the sorptive properties of tuff.

3.3 Granite Experiments--Activity 2.4.4 will receive data from Subtask 3.3 regarding the physical and sorptive properties of granitic rocks. Activity 2.4.5 will require data from and consultation with Subtask 3.3 personnel regarding the physical and thermal properties of Climax Stock granite and the transient thermal field during Heater Test No. 1.

4.1 Drilling Plans and Engineering--Activities 2.4.2 and 2.4.3 Contributing Investigators will participate in the planning and in the technical supervision of drilling and subsurface testing.

4.2 Field Geology and Core Library Support--Activities 2.4.1, 2.4.2, and 2.4.3 will obtain logistical and personnel assistance for field operations from this subtask.

Interfaces within subtask:

Continuing exchange of information among Subtask 2.4 activities will be assured by the Principal Investigator. Activity 2.4.4 (Solute-Transport Model) will be the focal point for integrating information from the other activities and for assistance in planning exploration and experimentation so as to provide data in the proper format for the modeling effort.

Interfaces with other programs:

Hydrologic investigations are being conducted in several areas under the National Terminal Waste Storage Program. Exchange of information, particularly in exploration techniques, will be encouraged. Generic studies planned for FY 1979 under the USGS direct-appropriation program will provide consultive advice. Intensive cooperation is planned in Activities 2.4.4 and 2.4.5 modeling, as well as in testing techniques that are applicable to 2.4.1 and 2.4.2.

Activity 2.4.4 Contributing Investigators will interface periodically with the Waste Isolation Safety Assessment Project (WISAP) to assure the best possible interchange of information and techniques between the USGS and WISAP modeling programs.

H. SUBTASK 2.5 TECTONICS, SEISMICITY, AND VOLCANISM

Objectives of Subtask and Activities

2.5 Tectonics, Seismicity, and Volcanism--The objective of this subtask is to assess the potential for faulting, damaging earthquakes, recurrence of volcanism, and local acceleration of erosion in parts of the southern Great Basin. This will be done by (1) investigating the rate, intensity, and distribution of faulting (the "tectonic flux") during approximately the last 25 m.y., with special emphasis on the last 10 m.y.; (2) monitoring and interpreting present seismicity; (3) studying the history of volcanism; and (4) evaluating past rates of erosion and deposition.

2.5.1 Regional Tectonics and Volcanism--The principal objectives of this activity are (1) to complete a preliminary study (begun in FY 1978) of faulting and volcanism on and near the Nevada Test Site, and (2) to continue studies of Quaternary alluvium, particularly near areas of faulting on and adjacent to southwestern Nevada Test Site.

2.5.2 Seismology--The principal objective of this activity is to begin full recording and interpretation of data from the seismic monitoring network installed in FY 1978.

Descriptive Summary

Activity 2.5.1 Regional Tectonics and Volcanism--USGS study of tectonics, volcanism, and related problems of the southern Great Basin is a long-term investigation that will provide background information for project decisions that will be made throughout the investigative period regarding the tectonic stability of proposed waste storage sites. Work during FY 1979 will concentrate on the southwestern part of NTS and adjacent areas, particularly Crater Flat and the Amargosa Valley. Mapping of alluvium and bedrock will be performed where needed for better understanding of the structural, hydrologic, and geologic framework. Further understanding of the volcanic and alluvial geochronology of the NTS will be pursued in

order to decipher the history of faulting and volcanism, and to allow better prediction of recurrence intervals and geographic distribution.

Volcano-tectonic studies to be done by LASL in cooperation with USGS will include (1) an appraisal of the potential for and disruptive effects of basaltic eruptions, and (2) initiation of work to better define the structural-volcanic history and regional significance of the Thirsty Canyon Tuff--the youngest (7.5 m.y.) major ash-flow sheet in the southern Great Basin. The Thirsty Canyon Tuff provides a valuable reference datum for determining tectonic deformation before and after 7.5 m.y. ago.

In order the improve the chronological record of volcanism, dating of volcanic rocks, particularly in areas adjacent to the Test Site, will be continued in FY 1979. Resolution of some discrepancies in dates obtained earlier will be required. This study will include several fission-track analyses on apatite in intrusive rocks, to give an idea of the thermal-tectonic history of parts of the area.

Dating of carbonate materials associated with faults and with soils in alluvium will be continued. In general, this work contributes to alluvial and fault chronology by determining minimum ages of faults and of alluvium displaced by faults. Trenching will be required at several locations to expose vertical sections of faults and soil horizons. Perhaps 1,500 linear feet of bulldozer or backhoe trenching will be required.

A report, including maps, on the Death Valley-Furnace Creek-Little Fish Lake Valley fault system will be provided by a contractor, who will complete a Ph.D. thesis on this fault system, the second longest right-lateral strike-slip structure in the United States. At the nearest point, this structure is only 40 km southwest of the Nevada Test Site. Results of this study will be interpreted with respect to seismicity recorded by the new seismic network.

Activity 2.5.2 Seismology--USGS will begin recording and reducing data on southern Great Basin earthquakes. The new seismic network will begin

full-scale data recording early in Calendar Year 1979. As data become available, they will be plotted on maps. Other parameters, such as fault-plane solutions and focal depths, will be calculated for larger earthquakes. Recording of earthquakes will also be done at several stations in borehole-surface configurations to allow the comparison of the response of surface and subsurface locations.

If a candidate repository site is identified in 1979, additional telemetered seismic stations will be installed in a tight configuration in order to determine whether there are any active faults near the site. If larger earthquakes or earthquake swarms occur at locations of particular structural interest, portable instruments will be deployed for relatively short intervals to obtain detailed information on epicenters and fault mechanisms.

Work will continue on improving epicentral locations of larger earthquakes in the southern Great Basin. This will be done by applying better velocity models to existing, mostly older data and should result in an improvement of correlation between some earthquakes and known structural sources. Better understanding of the time history of foreshocks and aftershocks may also result.

Interface Plans

Subtask 2.5 will interface with all other waste-disposal areal and site-specific investigations in the Great Basin.

Interfaces with other subtasks and activities:

1.1 Data Processing and Analysis--If a site becomes promising in FY 1979, cooperation with Subtask 1.1 will be sought to colocate ground motion surface and subsurface measurements with a seismic station in the close-spaced earthquake monitoring net planned for that site.

2.2 Geologic Investigations--The Subtask 2.5 Principal Investigator will provide investigators in Subtask 2.2 data on seismicity and volcanic rocks and evaluation of the potential for faulting and earthquakes in specific site areas on or adjacent to NTS.

2.3 Geophysical Investigations--Subtask 2.5 Principal Investigator will provide investigators in Subtask 2.3 with guidance on tectonic and structural problems that are critical to regional and site characterization.

2.6 Geochronology--Subtask 2.5 Principal Investigator will work closely with investigators in Subtask 2.6 in improving the geochronology of igneous rocks, alluvium, and carbonate materials in the southern Great Basin.

4.1 Drilling Plans and Engineering--Subtask 2.5 will draw support in surveying, road construction, excavation, and other engineering and construction tasks as needs are identified and funds are available.

4.2 Field Geologic Support--Subtask 2.5 will request and receive, as resources are available, logistic and geologic support from Subtask 4.2.

I. SUBTASK 2.6 GEOCHRONOLOGY

Objectives of Subtask

2.6 The primary objective of the Geochronology subtask is to provide K/Ar, U-series, and fission track ages on geologic samples that are suitable for one or more of the various dating techniques. The samples used for dating usually will be selected or provided by the geologists that are working directly on field studies for the Geologic and Hydrologic Investigations task. A Radiometric Age Data Bank (RADB) which contains files for published age determinations in Nevada will be made available for these geologic investigators. An additional objective is to monitor the U-series disequilibrium systematics in fracture-fillings in silicic tuff samples selected from drill cores obtained from the Nevada Test Site.

Descriptive Summary

Reliable geochronology investigations are essential to the needs of the field geologists investigating the tectonic, volcanic, and hydrologic processes that are being evaluated for potential site selection.

K/Ar dating will be used for tuff and basalt samples, where the age range is greater than about 100,000 years, and for mineral separates obtained from granitic rock samples. This technique is most useful for determining the date of the youngest volcanism in or near the Nevada Test Site.

Fission track dating, particularly of apatite but also of zircon and sphene, will be applied where these minerals can be separated from tuff, granitic rocks, and other igneous and metamorphic rocks. Fission tracks in apatite anneal at about 100° C., and fission track dating is most useful in determining when various blocks of rock, containing apatite, most recently passed through the 100° C. isochron. Zircons and sphenes anneal at higher temperatures and are useful for dating the age of the rocks. Such dating complements K/Ar dating and in certain cases, fission track dating can be done where K/Ar dating cannot.

U-series dating is applicable in the age range of 5,000 to 400,000 years and will be used to date carbonate-bearing samples. It is anticipated that most of the samples submitted will be either (1) calcite vein materials, (2) travertine, or (3) rock caliche. Dating of carbonate fracture fillings should aid in determining the age of faulting and recurrence of faulting. The technique is applicable to a greater age span than ^{14}C and should be applicable in studies where appropriate volcanic rocks (K/Ar dating) or wood (^{14}C) is unavailable. Uranium-trend dating has an age range of 10,000 to about 800,000 years; this technique could be useful in estimating the time that colluvium deposits were formed if suitable samples can be collected.

Investigations will be expanded to include ^{238}U-^{234}U-^{230}Th-^{226}Ra-^{222}Rn-^{210}Pb systematics in fracture-filling material by gamma-ray and alpha spectrometry as a potential tool for assessment of fault movement in young events. In addition, ^{210}Pb dating could be explored in lake sediments, and other suitable environments, to determine its usefulness to recurrent faulting during the last 100 years.

All of the geochronology investigations are dependent upon collaboration with the geologists that are working directly on field studies for the Geologic and Hydrologic Investigations task. Results of the geochronology work will be supplied as expeditiously as possible to the contributing geologists.

Interface Plans

It is anticipated that geochronology will interface with all of the other subtasks included under Task 2. Most of the dating work will be initiated by Subtasks/Activities 2.2, 2.4.3, and 2.5.1. Information exchange within Subtask 2 initially will take place directly between field geologists and the individual geochronologists included in the Geochronology Subtask. The compiled goechronology results will be contained in monthly reports submitted by the Principal Investigator.

J. SUBTASK 3.1 ARGILLACEOUS MEDIUM INVESTIGATIONS

Objectives of Subtask and Activities

3.1 Argillaceous Medium Investigations--The objective of this study is to characterize sufficiently the response of argillaceous rock to the thermal and structural loadings imposed by the emplacement of high-level waste.

3.1.1 Eleana Heater Experiment--The objectives of this activity are: (1) to determine whether Eleana argillite can withstand sufficient thermal loading to allow economic isolation of high-level waste, (2) to provide data for corroboration of thermal and mechanical models, and (3) to assess the reliability and suitability of available test hardware and instrumentation and to determine if the development of new instrumentation technology is required for future long-term tests.

3.1.2 Laboratory and Modeling Support--The objective of the laboratory portion of this activity is to determine sufficient thermal, mechanical, mineralogical, physical, and chemical properties of samples from the Eleana Formation as functions of temperature and pressure to allow assessment of the effectiveness of the argillaceous media as a waste migration barrier. The objectives of the modeling portion of this activity are: (1) to analyze the near-field thermal and structural response of argillite to operation of the heater experiment to determine the effectiveness of present models and areas where model improvements may be required and (2) to analyze far-field response of the entire Syncline Ridge area to the emplacement of a high-level waste repository to obtain a preliminary estimate of its total waste storage capacity.

Descriptive Summary

Work to be performed in achieving the objectives is described below.

3.1.1 Eleana Heater Experiment

SL has fielded an in situ heater experiment to determine the near-field thermomechanical stability of the Eleana under thermal loading. This experiment is essential for three reasons: (1) massive thermally induced fracturing could decrease the effective in situ thermal conductivity sufficiently to cause unacceptably high canister temperatures at constant power; (2) extensive fracturing might also mechanically impede canister retrieval by either trapping the canister in place or by resulting in mechanical instability of the surrounding medium; and (3) fracturing could provide pathways for radionuclide migration in case the canister itself is breached.

The full-scale heater experiment was begun on May 16, 1978, and has been operated at a constant power of 3.5 kW. It is planned to remain at this power level at least until the 120-day data can be analyzed. This is necessary in order to better understand recent data concerning water collection, gas pressure communication between holes, and water evaporization by the heater.

The full-scale experiments should be completed in mid-FY 79. Fracturing in the near-field region will be evaluated by gas transmissivity measurements which will be compared with pretest data to evaluate changes caused by the thermal loading.

Results of the Eleana heater experiments should be available in report form by November 1, 1979.

REECo will provide utility and logistic support as requested throughout the duration of the heater experiment at the Synclide Ridge, Eleana location, and provide posttest support.

H&N will provide survey support and necessary documentation to record the "as-built" configuration of the Eleana heater experiment at the Syncline Ridge location.

K. SUBTASK 3.2 TUFF MEDIA INVESTIGATIONS

Objectives of Subtask and Activities

3.2 Tuff Media Investigations--The overall objective of this subtask is to gain an understanding of the phenomenological response of tuffs to the emplacement of nuclear waste, through in situ thermomechanical and geochemical experimentation, combined with broad-based laboratory and modeling efforts. In addition, an initial data report on tuffs will be generated at the end of the fiscal year, as a major step towards an Interim Tuff Assessment Report, to be completed in FY 80.

3.2.1 Tuff In Situ Test--The objectives of this activity are: (1) to evaluate critical issues for the assessment of tuff as a geologic isolation medium for high-level waste by performing in situ phenomenological experiments, and (2) to identify critical mechanisms which would disqualify tuff from further consideration as a disposal medium.

3.2.2 Laboratory and Modeling Studies--The general objectives of this activity are: (1) to develop the data base and modeling capability needed for meaningful field experimentaion and realistic parametric modeling in tuffs, and (2) to provide generic information on a variety of tuffs for comparison with other candidate repository media, and (3) to provide data adequate for making decisions regarding the potential of specific tuffs as a repository medium or as barriers to radionuclide migration.

3.2.3 Assessment Evaluation--The objectives of the assessment evaluation are: (1) to prepare a preliminary data report on tuff by the end of the fiscal year, and (2) to define and implement a research program which addresses the areas of information needed for a proper assessment of tuff as a storage medium.

Descriptive Summary

Overall objectives of the Tuff Experiments subtask will be accomplished by completion of the three activities described below:

3.2.1 Tuff Heater Experiments

SL will perform phenomenological thermal experiments using an in situ heater in welded tuff in the G-Tunnel complex at NTS. These experiments are to address issues that are important to the assessment of tuff as a waste storage medium. The effects of water contents on possible phenomena due to emplacement of heat-producing waste are to be studied in experiments in welded tuffs. The experiments are limited in scope but will attempt to measure in situ thermal conductivity, in situ permeability, and volatile generation resulting from a thermal load as secondary objectives. These at-depth experiments will provide a basis for design of more sophisticated at-depth experiments and will allow new instrumentation techniques to be tested.

REECo will provide drilling and construction support for a tuff in situ test.

F&S will provide technical engineering support for drilling operations associated with the test and record and report the lithology of the media within and surrounding the holes.

H&N will provide survey crews and engineering design and construction estimating support for the experiment.

3.2.2 Laboratory and Modeling Studies

SL has prime responsibility for directing the thermomechanical, thermal physics, and modeling activities.

F&S will provide the technical engineering support and activities to record and report the lithology of the media within and surrounding the holes utilized in conducting the Eleana heater experiment.

3.1.2 Laboratory and Modeling Studies

SL will coordinate the gathering of material property data on argillite from Syncline Ridge and Calico Hills on NTS, aimed at detailed support of the ongoing Eleana heater experiments, and a comparison of materials from these two areas. In addition to adding to the general data base, special attention will be given to the dehydration and clay mineralogy. Rate-dependent effects on thermomechanical properties and effects of confining pressure on thermal conductivity and expansion will be investigated. Detailed modeling of the Eleana heater experiment will be completed. Also, the thermomechanical global modeling for argillite will be done, including considerations of hydrothermal transport. Geochemical work on argillite will focus on laboratory simulation of natural crack flow. Scoping K_d values will be gathered on both argillite and hornfels from Calico Hills for comparison with results on material from Syncline Ridge.

H&N will provide materials test laboratory support to determine scoping material property data as requested by the Sandia Laboratories and the modeling support contributing investigator.

Interface Plans

Interfaces with other subtasks:

2.2 Geologic Investigations--Subtask 3.1 will obtain off-site tuff and argillite samples for screening material property measurements in order the characterize their potential for a repository medium.

Interfaces within subtask:

Major interface and coordination will occur between preexperiment thermal/mechanical modeling, material properties data collection, and decision

regarding heating/power profile of heater experiment. All contributing investigators will be directly involved in all major decisions impacting laboratory and field programs.

LASL has the prime responsibility for directing the mineralogy, petrology, and geochemistry activities.

SL will coordinate and assist in compilation of thermomechanical and thermophysical data on tuffs relevant to their usage as a storage medium, as well as monitoring results of modeling efforts. The gathering of media scoping data, already begun, will be continued. Specific properties such as thermal conductivity, thermal expansion, specific heat, tensile and compressive strengths, and gas and liquid permeability will be evaluated as functions of porosity and water content. Special attention will be focused on (1) collection and evaluation of data required for modeling of the in situ thermomechanical experimentation in G-Tunnel and measurements on material from the Yucca Mountain exploratory hole. Thermomechanical modeling of near- and far-field behavior of tuffs will be carried out in support of both planned in situ experimentation and repository conceptual design activities. The global modeling will use the Yucca Mountain lithology as a reference.

LASL will determine the petrographic description of tuffs from the Yucca Mountain exploratory hole UE25a#1. The object of the effort is to determine the major mineral phases present, their approximate chemical composition, and their approximate relative abundance and to describe textural relationships in the rock specimens. The work will involve specialized sample preparation, optical microscopy, electron probe microanalyses, and x-ray diffraction is deemed necessary by petrologists experienced in volcanic rocks. Preliminary data and sample splits shall be available as necessary for correlation with other physical- and chemical-properties determinations. LASL will work with SLA in the interpretation of materials properties with respect to geologic properties. LASL will assist for the recovery of samples from other geologic holes in tuff and in the recovery and packaging of these samples.

LASL will also extend sorption measurements to include material from Yucca Mountain hole UE25a#1 with batch experiments under both ambient and reduced oxygen conditions. This will be done to provide data specifically

for Yucca Mountain, to extend the data base of sorptive properties as a function of nuclide, mineralogy, and location of the tuffs, and to understand the effect of oxygen on the measurements. The behavior of plutonium, the other actinides, and technetium is poorly understood under the conditions of slightly basic tuff ground water. Formation of polymers, colloids, and complex ions is possible, and the oxidation state of some of the elements is uncertain. The sorptive behavior of these elements will be examined in greater detail, investigating such variables as concentration of the nuclide and method of preparation of the traced ground water. Column procedures will be developed using crashed materials, solid cores, and cores containing fractures to obtain an understanding of the manner that nuclides are transported in the specific geologic environment. Solution and solids used in sorption studies will be carefully characterized. Microautoradiographic work for the location of specific sorption sites will be continued and extended to other tuff samples and nuclides. The state of aggregation of species in solution will be investigated with this technique.

A series of hydrothermal "soak" tests will be planned, in which samples will be subjected to bulk confining pressures up to 200 bars at temperatures 50 to 250^{o} C. for a six-month period and characterization studies will be carried out on the materials before and after the test. An in situ field test of migration of nuclides in tuff will be planned. Such tests are necessary to demonstrate the appropriateness of laboratory experiments and the nuclide transport models. They may also suggest new experiments and models.

3.2.3 Assessment Evaluation

SL and LASL, in coordination with USGS, will submit an initial tuff data report by the end of FY 79, based on work completed to that time. Data included in this report will form the basis of an interim tuff assessment report to be submitted for NAS-level review in FY 80.

Interface Plans

Interfaces with other subtasks:

2.2 Geologic Investigations--Work performed in the tuff scoping evaluation will be coordinated with the geophysical and geological/hydrologic investigation at NTS. The Principal Investigators for Subtask 3.2 are responsible to see that this takes place.

Interfaces with this subtask:

The Contributing Investigator for Laboratory and Modeling Support (3.2.2) is expected to assemble approximate information from the literature search and related data acquisition so that necessary modeling can be completed in a time frame adequate to support the thermal experiment should it be required. The Contributing Investigator for Tuff In Situ Experiment (3.2.1) is expected to provide coordination and guidance for the REECo, F&S, and H&N support.

L. SUBTASK 3.3 GRANITIC MEDIUM INVESTIGATIONS

Objectives of Subtask and Activities

3.3 Granitic Medium Investigations--The objective of this subtask is to provide a basic characterization of the Climax granite response to thermal and structural loadings. Specifically, the objective is to obtain the response at depth of a typical Basin and Range granite (the Climax Stock) to an imposed thermal load and answer the question of whether a crystalline rock waste repository can be established at or near NTS.

3.3.1 Climax Stock Heater Experiments--Heater Test No. 1 was designed and constructed in FY 77 and operated in FY 78. For FY 79, the objective is to complete the analysis of the data, report the results, and carry out field activities associated with a second series of heater experiments being planned in conjunction with the Spent Fuel Test in the Climax Stock (Task 7).

3.3.2 Laboratory and Modeling Support--The objectives of the Laboratory and Modeling Support are to (1) assist in analyzing Heater Test No. 1; (2) prepare a conceptual design, and then a test plan, for the Rock Mechanics Test Facility; and (3) address problems of instrumentation for rock mechanics measurements in heater tests.

Descriptive Summary

3.3.1 Climax Stock Heater Experiments

LLL will complete analysis of the data from Heater Test No. 1 and report the results.

3.3.2 Laboratory and Modeling Support

LLL will carry out a series of activities in support of the heater test series.

For Heater Test No. 1, the principal activity will be calculational analysis of the thermal and permeability measurements. For the Rock Mechanics Test Facility, thermal properties measurements are needed for proper scoping calculations, and a series of scoping calculations must be completed.

The Technical Concept document will be prepared for a Rock Mechanics Test Facility. This will include a layout based on finite element calculations and will include the rationale for the test and document the analysis leading to the design.

M. SUBTASK 4.1 DRILLING PLANS AND ENGINEERING

Objective of Subtask

4.1 Drilling Plans and Engineering--The objective of this subtask is to provide for accomplishment of technical support requirements of project participants by NV contractors.

Descriptive Summary

The NV contractors will provide general technical engineering support on drilling, mining, construction, and studies related to the project as requested. This general support will involve (1) participation at certain project meetings where engineering, logistical, or estimating expertise is required for planning, review, and/or recommendation purposes; (2) preparation of planning data, estimates, and evaluation of various proposals developed by Technical Project Officers; and (3) other miscellaneous technical services or support work are required.

Interface Plans

This subtask was established to provide for required miscellaneous support services of the NV contractors to NV and project participants on an as-requested basis only. Assigned Principal Investigators and Contributing Investigators of the various subtasks and activities in need of miscellaneous support services shall make their specific requests in the form of a Criteria Letter. Criteria is to be addressed to the Director, NTSSO, and be signed by the appropriate Technical Project Officer. Carbon copies of Criteria Letters should be provided to the NV Project Office. The Project Coordinator will then take appropriate action to assure the requested support services are obtained and, under normal circumstances, provided directly to the requesting party.

N. SUBTASK 4.2 FIELD GEOLOGY AND CORE LIBRARY SUPPORT

Objectives of Subtask and Activities

4.2 F&S Geology and Core Library Support--The objectives of this subtask are to (1) provide and maintain a cadre of F&S geologists to support the project participants; and (2) to provide for prorate core library and general support to maintain, handle, and store rock samples in the Mercury Core Library and provide general support to USGS on the project.

Descriptive Summary

4.2 Field Geology and Core Library Support

USGS will provide technical coordination and instruction to the F&S geologists. Activities at the Mercury Core Library include the storage, handling, labeling, retrieval, and shipping of rock samples and documenting distribution of samples obtained from field operations in support of the project.

F&S--The principal duties of the F&S geologists are the monitoring of drill holes in the Yucca Mountain and Calico Hills areas and the procurement, identification, description, and distribution of rock samples from these holes. Other activities include the reporting on current progress of drilling operations to the senior geologist-in-charge (USGS), preparation of reports upon completion of drill holes, and ad hoc activities in support of the U.S. Geological Survey and other appropriate project participants.

REECo will provide general support, office space, clerical assistance, vehicle procurement and maintenance, radio support, and other logistic operations as required in support of USGS.

Interface Plan

Interfaces with other subtasks:

The Field Geologists will provide continuing support to various other subtasks as requested by Principal and Contributing Investigators. The Principal Investigator for Subtask 4.2, Field Geology and Core Library Support, is responsible for assuring that requested support and interfaces are accomplished.

0. SUBTASK 5.1 OVERVIEW QUALITY ASSURANCE

Objective of Subtask

5.1 The objective of the Overview Quality Assurance subtask is to continue development and assure implementation of the Quality Assurance Program for the Nevada Nuclear Waste Storage Investigations.

Descriptive Summary

SL will continue definition of quality program requirements with emphasis on updating requirements to reflect new NRC standards, regulations, and guidelines specific to waste repositories as they become available. In the interim, existing NRC regulations based on 10 CFR 50, Appendix B, will continue as the basis for quality program requirements.

Overview QA review of quality programs of NTSSO contractors will be complete by January 15, 1979 (Milestone 2). Overview QA review of quality program plans submitted by the major participating laboratories/agencies during FY 78 shall be completed by February 1, 1979 (Milestone 3). Results of all Overview QA reviews shall be forwarded to DOE/NV and respective participating contractors.

A preliminary draft of the overall Quality Assurance Plan for the Nevada Nuclear Waste Storage Investigations will be issued by November 1, 1978 (Milestone 1). This draft will address project management and Overview QA activities. A subsequent draft of the overall Quality Assurance Plan including specifics of all participant quality program plans will be issued April 1, 1979 (Milestone 4). All comments received during review of the drafts will be incorporated into the Quality Assurance Plan to be issued June 1, 1979 (Milestone 5).

The complete Quality Assurance Plan will include as a minimum:

1. Statement of Policy.

2. The listing of referenced documents including NRS and DOE regulations and ANSI specifications. At this point in time, the applicable regulations are DOE Manual Chapters 0531 and 0820; 10 CFR 50, Appendix B; and ANSI N45.2. The proposed 10 CFR 60 is anticipated to replace 10 CFR 50, Appendix B, when it becomes available.

3. A glossary of terms.

4. The identification of participating organizations.

5. Descriptions of participants' quality programs including:

   a. Participation areas.

   b. Definition of the organization that the quality program will cover.

   c. Description of the contents and use of participant organization quality program manuals.

   d. Listing of quality procedures as applicable to each of the eighteen (18) criteria of 10 CFR 50, Appendix B.

6. Definition of the document retention system to include:

   a. Specification of a program document repository.

   b. Contents and control of the document repository.

   c. Methods and timing of inputs to the document repository.

   d. Responsibility of participants for inputs.

Overview Quality Assurance will continue throughout FY 79 with the audit program of site/media investigation activities begun in FY 78.

Interface Plans

Overview Quality Assurance will interface primarily with the participant Quality Assurance organizations defined in Subtask 5.2. Overview Quality Assurance will interface with all other tasks to assure adequate quality program coverage for all activities. An interface with other NV quality programs will be maintained to aid in the development of consistent policies and procedures when possible. In addition, contacts with NRC are anticipated.

P. SUBTASK 5.2 PARTICIPANT QUALITY ASSURANCE

Objective of Subtask

5.2 The objective of the Participant Quality Assurance subtask is implementation and assessment of effectiveness through internal audits of quality programs developed by each principal investigator defined above for subtasks within their responsibility.

Descriptive Summary

LASL, LLL, SL, USGS, DOE/NV contractors will finalize development and implement quality programs for activities which control or affect the acquisition of data from which conclusions and decisions will be reached concerning the site/media selection for the repository. The programs are administered by the individuals who are responsible to the Technical Project Officer in order to maintain an independent assessment of the quality program effectiveness.

Quality program plans of DOE/NV contractors will be submitted to DOE/NV and Quality Assurance for review and comment (Milestone 1). All participating organizations, USGS excepted, will submit quality program plans for approval by November 1, 1978 (Milestone 2). The schedule for the quality program plan submittal by USGS will be established after retention of a QA consultant. Implementation of quality programs by all participating organizations except USGS will continue during FY 79 with ongoing program assessment through audits by participant Quality Assurance organizations and Overview Quality Assurance.

Participant quality programs will define as a minimum:

1. Organization

    a. Organizational structure for participant activities showing QA.

    b. Interface lines of QA/QC within the participating organization.

2. Definition of the Participant Quality Organization

   a. Name(s), organization assignment(s), and telephone number(s).

   b. Qualifications.

   c. Relationships between quality personnel and project management.

3. Quality Program Description

   a. Identification of activities performed by the participating organization.

   b. Identification of critical or safety-related activities or elements of activities.

   c. Identification of quality requirements (per 10 CFR 50, Appendix B) for critical or safety-related activities with listing of applicable quality control procedures.

   d. Assurance of quality program implementation (i.e., audits).

   e. Cross-reference of procedures to applicable NRS regulations.

4. Project Document Control

   a. Identification of what should be documented.

   b. Methods and examples of document control within the project.

   c. Storage plan and procedures for documents retained in the participant's repository.

   d. Method and frequency of document transfer to the central document repository.

Interface Plans

Each participant's quality program will identify all organizations and activities that the program is written to cover, including the participant Quality Assurance organization. The participant Quality Assurance organization will interface with all other organizations within that program to assure proper implementation and compliance to the defined quality program. Additionally, each participant Quality Assurance organization will interface with Overview Quality Assurance (Subtask 5.1).

Q. SUBTASK 6.1 TECHNICAL OVERVIEW

Objective of Subtask

6.1 Technical Overview--The objective of this subtask is to provide technical support to the NV Project Manager for the Nevada Nuclear Waste Storage Investigations.

Descriptive Summary

SL will work with the NV Project Manager, participating laboratories, agencies, and subcontractors to plan and coordinate a balanced technical project to determine the feasibility of using the NTS for geologic isolation of nuclear wastes. This will be accomplished by assisting NV (1) with the development of both short- and long-range plans, including evaluating proposed portions of the plans; (2) by reviewing the progress of and recommending means to improve the technical performance of existing subtasks; and (3) assist NV with ONWM/HQ and NRC interfaces on all technical matters. A complete description of the responsibilities of the technical overview contractor is provided in Section III of this document.

The first subtask function, assistance with planning, is guided by the technical approach described in Section IV and characterized by the subtask work plans included in Section V of this project plan document. Assistance with the preparation and evaluation of future revisions to the project management and cost plans, as required by project redirection at significant decision points, is an ongoing responsibility of this subtask.

The second subtask function, evaluation of the progress of existing subtasks, is a project requirement. Sandia will assist NV in these evaluations by the use of appropriately trained Sandia Laboratories personnel and qualified consultants. Technical evaluations will be accomplished by formal periodic reviews, visits to field and laboratory

projects, and meetings with project participants. Major technical recommendations and position papers will be prepared and provided to NV as appropriate. Technical assistance to the Office of Public Affairs, NV, will also be provided on technical project matters as required.

The third subtask function, interfaces with national management and regulatory bodies on technical matters, is required for timely assessment of project objectives. Sandia will participate in the interfaces and assist NV in evaluation of technical requirements accruing from potential future redirections of national waste management policy and/or regulatory criteria. Assistance in advising national management and regulatory personnel concerning technical issues will also be provided to NV as part of this subtask function.

Interface Plans

This subtask requires interfacing with all other subtasks and project participants. In addition, substantial interfacing with ONWM/HQ and NRC in cooperation with DOE/NV is anticipated.

R. SUBTASK 6.2 SITE SELECTION

Objectives of Subtask

6.2 The objectives of the Site Selection subtask are to (1) synthesize procedures and criteria for repository site selection and (2) to use these procedures and criteria to evaluate potential sites on NTS and adjacent areas in order to assure public health and safety, as well as determine economic and other inputs of candidate sites.

Descriptive Summary

For FY 79 a new programmatic function is proposed to focus on the process of repository site selection. Initiation of this subtask is contingent on approval by DOE/NV management and the State of Nevada. Several site selection activities in support of the waste isolation program on or near NTS are encompassed by this subtask.

First, general procedures and criteria are to be developed to guide selection of candidate repository sites from potential sites identified and studied by the other program tasks. Information from geologic, media, laboratory, and engineering studies from the NTS and other waste isolation programs, as well as EPA and NRC regulations and guidelines, will be used to develop these procedures and criteria. Second, potential repository sites will be evaluated by applying the procedures and criteria developed. The goal of this phase of the site selection subtask is to evaluate a proposed site for a repository. Of prime importance here are the considerations of public health and safety. Cognizance of proposed field test and in situ experimental programs is needed to complement the site selection process. It is especially important that facilities which, for example, utilize deep drill holes or involve extensive mining be located where they would not compromise the licensing of a potential repository site.

The site selection activity will be performed by a three-tiered organization consisting of Management, a Site Selection Steering Committee, and a Site Selection Working Group. Management consists of the NV Manager and the Governor of Nevada, who will set policy and priorities, define responsibilities for state and federal participation, review lower-tier recommendations and forward these to DOE/HQ and other agencies as required, and make public information releases.

The Steering Committee consists of the Project Manager for the Nevada Nuclear Waste Storage Investigations, a representative of the State of Nevada, the Technical Overview Officer, and others as required on a temporary basis. The Steering Committee selects personnel for the Working Group, furnishes the Working Group with task items, and makes recommendations to Management based on the efforts of the Working Group.

The Working Group is an interdisciplinary committee chaired by a member of the technical overview laboratory. Members of the group include representatives of the three project laboratories (LASL, LLL, and Sandia), the USGS, the State of Nevada, DOE/NV, a support contractor if required, and up to three persons from the scientific and environmental community. The latter three members will be selected to augment the Working Group's areas of expertise. In addition to the activities described in the first paragraph of this subtask, the Working Group will compile reports and technical documents on their site selection activities and will brief various technical-level groups as requested by the Steering Committee or Management.

Interface Plans

The Site Selection subtask will interface with all of the other project tasks. Much of this interface is accomplished internally both in the Steering Committee and Working Group, since most of the members of these committees are project participants. In order to ensure a strong interface with the rest of the project, the Working Group will meet monthly to conduct business in support of its objectives. The Working Group members

will be invited to participate in periodic technical reviews to assure their current knowledge of the project.

In addition to interface within the Nevada Nuclear Waste Storage Investigations, the Site Selection Working Group will establish good communication with other national waste isolation programs, ONWI site slection activites, and keep informed of EPA and NRC regulatory programs. It is the responsibility of the Steering Committee and the Working Group Chairman to see that the external interfaces are effectively maintained.

S. SUBTASK 7.1 SPENT FUEL TEST MANAGEMENT, DESIGN, AND PROCUREMENT

Objectives of Subtask and Activities

7.1 The overall objective of this subtask is to accomplish the technical direction, design, and procurement activities required to conduct the Climax Spent Fuel Test. The FY 79 objective is to advance the preparations for the test to a level consistent with initiation of fuel storage operations in the first half of FY 80.

7.1.1 Test Management--The objective of this activity is to provide the technical management functions required to conduct the test. These functions include documentation of test plans, schedules, and cost estimates and coordination with NV of technical considerations and interactions with other project activities.

7.1.2 Test Design--The objective of this activity is to provide the overall technical concept and detailed design of the test, development of instrumentation plans, and criteria for the engineering, construction, and technical support to be provided by other participants. Detailed design of the canister-handling system will be accomplished.

7.1.3 Test Procurement--The objective of this activity is to procure and provide those hardware elements associated with the canister-handling and instrumentation systems for which LLL is directly responsible.

Descriptive Summary

LLL will provide the overall technical management functions for the Spent Fuel Test--Climax. This will include responsibility for preparation of the required documentation for the test, including test plans, a Safety Assessment Document, and operating procedures. LLL will, in coordination with other test participants, maintain current estimates of cost and

schedule for the test. LLL will be principal NV technical contact for considerations relating to interaction with other elements of the project and other NTS program activities. LLL will provide technical support to the NV Public Affairs Office as requested.

LLL will develop the technical concept for the test, including detailed calculations of the anticipated effects, and specification of the test geometry. LLL will provide the technical criteria for the engineering, construction, and support to be furnished by other project participants.

LLL will be responsible for definition of the test instrumentation appropriate to satisfy the technical concept objectives, safety considerations, and documentation.

LLL will accomplish the detailed design of major elements of the canister-handling system required to transport the fuel canister assemblies from the E-MAD encapsulation facility to the test storage area and retrieve them in a safe and reliable manner. These elements will include a shielded cask surface transporter for use on the NTS road system which will interface with the E-MAD remote handling equipment and with the canister access hole lowering system; and a rail-mounted transfer cask which will move the assemblies between the bottom of the access hole and the storage holes in the canister storage drift. Other elements of this handling system will be designed or specified by LLL for acquisition by other project participants.

LLL will procure directly those elements of the test support hardware which require close integration or substantial assembly effort to be made operational. LLL will also procure the test instrumentation and provide for the calibration, installation, and operation of the instrumentation, including a computer-based data acquisition and reduction system and an appropriate data recording trailer complex.

Interface Plans

Significant interfaces exist between all the subtasks which support Task 7.0. The LLL subtask leader will be responsible for the coordination and integration between the participating agencies and contractors.

T. SUBTASK 7.2 SPENT FUEL TEST--FUEL CANISTER ENGINEERING AND SUPPORT

Objectives of Subtask and Activities

7.2 The overall objective of this subtask is to accomplish the necessary engineering design, procurement, and operations to provide the packaged fuel assemblies to support the Spent Fuel Test. In addition, other related engineering and procurement activities will be accomplished as described below.

7.2.1 Fuel Canister Engineering--The objective of this activity is to design and manufacture the complete fuel canister packages, including closures and shield plugs.

7.2.2 Support Engineering--The objective of this activity is to design and manufacture other hardware for the test. This effort includes the electrically heated simulation packages and the storage hole liners.

7.2.3 E-MAD Operations--The objective of this activity is to perform the fuel assembly encapsulation and interim storage operations at the E-MAD facility.

Descriptive Summary

Westinghouse-AESD will perform the engineering design and manufacturing operations required for the fuel storage canisters. The activities will include design and procurement of canisters, canister closures, shield plugs, storage hole liners, and electrically heated simulator assemblies. Other activities will include design and procurement of E-MAD handling tools and fixtures, assistance in arranging the acquisition of the fuel assemblies, and supporting management functions in direction and coordination of design, procurement, manufacturing, and technical support operations.

A total of 14 fuel canister assemblies will be fabricated and certified. Six electrical simulator assemblies and 18 storage drift liners will be required.

Mechanical strength testing of one canister assembly will be performed.

Analyses will be performed as required to support the preparation of the test Safety Assessment Document.

Assistance in the acquisition of fuel assembly characteristics and assistance in planning for fuel procurement and transportation will be provided.

U. SUBTASK 7.3 SPENT FUEL TEST FACILITY CONSTRUCTION

Objective of Subtask

7.3 The overall objective of this subtask is to accomplish the design, construction, and support activities required to support the Spent Fuel Test. This effort will include architect-engineering services (F&S and H&N) and construction and support services (REECo).

Descriptive Summary

F&S will provide A-E services for all mining and drilling-related operations. Services will include preparation of detailed plans, estimates, and specifications and field engineering and inspection services. The major elements in this area will include the canister access hole, the complex of horizontal drifts to be excavated for the test, and the storage holes in the canister storage drift.

H&N will provide A-E services for all other facilities which support the test and will provide all survey support to establish and document the orientation and location of all test installations. The major elements for which H&N will be responsible include electrical power distribution; the canister access hole hoist, cable, and headframe; and the detailed outfitting of the storage drift to provide shielding collars, rails, and other appurtenances.

REECo, as the prime NV operating contractor, will provide mining, drilling, and other construction effort and will provide the operations and maintenance support, including procurement of materials and subcontract services as required.

The basis for all activities of the NV A-E and operating contractors will be the submission of the specific criteria by LLL to NTSSO with a copy to the Project Manager, NV, and will conform to the procedures as specified in the NTSSO-SOP-6001.