

SCOPE OF WORK

**Origin of Shallow Secondary Carbonate and Silicate Deposits
on and near Yucca Mountain, Nevada**

**Edited by
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U.S. Geological Survey

8 MAY 1985

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PDR WASTE
WM-11**

PDR

INTRODUCTION

Problem

Shallow, secondary calcite and silicate deposits are common in the Yucca mountain area. The deposits occur as vein fillings, as zones in soil and alluvium and along the walls of fractures and faults. The origin of the calcite and silicate deposits has been the subject of discussion since the Yucca mountain area was suggested as a site for the possible underground storage of nuclear waste. One school of thought holds that some of the deposits are the result of hydrothermal activity associated with the volcanic activity in Crater Flat. Other workers have suggested that some of the deposits are the result of springs formed when the water table was much higher during the Pleistocene. Data collected recently suggests that many of the secondary carbonate deposits may be the result of water movement downward from the soil zone.

The origin of these deposits is of concern in development of a nuclear waste storage site at Yucca Mountain because, if in fact they are the result of hydrothermal activity in the recent past, then evidence exists that the storage site may be affected in the future by the movement of hydrothermal water or nearby volcanic activity. If further study indicates that the deposits are the result of water moving through the soil zone from precipitation then it should be possible to demonstrate that there is no evidence for the existence of hydrothermal springs or activity at the repository site in the recent past. This study would also provide information as to occurrence, location and amount of spring discharge during wetter

periods of the Pleistocene.

Objectives

There are 2 objectives of this study:

- To demonstrate, within the degree of accuracy available of the state of the existing arts and sciences, the origin and geologic history of the shallow secondary carbonate and silicate deposits on and near Yucca mountain.
- The determination of the existence and type of any spring discharge sites on and near Yucca Mountain.

Approach

Because of the many types of data relevant to the solution of this problem the approach in this study requires an interdisciplinary effort by many different workers. The study is planned in phases, however, several phases could be in progress at the same time.

- Phase 1.-- Using existing data and geologic information develop maps of the location of all secondary deposits of calcite/silica on and near Yucca Mountain. Develop gross classification system and classify all deposits and sample each class. Develop geologic relationships for various classes of deposits. Develop relationship of secondary deposits of calcite/silica to bedrock units, soil units in the Sand Ramps, spring deposits of the Amargosa desert and hydrothermal deposits near Wahmonie. Excavate trench, south of Yucca mountain and west of Busted Butte, at site

of possible paleospring. Extend trench 14 about 16 feet eastward in order to sample vein deposits in bedrock. Map trenches and collect samples for classification. Evaluate data and information collected and determine if necessary to proceed with following phases. The following major work items are apart of this phase:

- * Initial planning and field inspections.
 - * Trenching and mapping of possible spring deposit south of Yucca Mt.
 - * Trench 14 extension eastward into bedrock to expose calcite veins.
 - * Reduction of existing geologic data to maps.
 - * Mineralogy, chemistry and biology of collected samples.
 - * Initial mapping of Sand Ramps.
 - * Installation of shallow soil moisture tubes and sample collection from Sand Ramps.
 - * Evaluation of collected data and report production.
- Phase 2.-- Develop chemical, isotopic, biologic and mineralogic signatures for each class of secondary deposit from samples collected in phase 1. Develop age and structural/stratigraphic relationship for each classification of secondary deposit. Develop library of chemical, isotopic, biologic and mineralogic signatures of modern carbonate and silicate deposits for which the mode of formation is known for comparison with signatures from the secondary deposits of Yucca mountain.

- Phase 3.-- Correlate signatures of the various secondary deposits of Yucca Mountain with the signatures of deposits of known mode of formation and with the geologic, tectonic and hydrologic history of Yucca mountain.

- Phase 4.-- Using the information collected in the prior phases produce final reports on the origin of the shallow, secondary vein filling material of Yucca Mountain, hydrology of the sand ramp deposits and short, specialized topical papers.

Staffing

This study will use existing personnel on an as-needed basis; however, because of the large number of topical fields involved many different individuals or groups will be required part-time for completion of the study. The services of the following may be required from time to time during the period of this study:

Name	Unit	Field of Study
John Whitney	USGS/GD	Sand ramps
Ralph Shroba	USGS/GD	Soils/sand ramps
Bob Scott	USGS/GD	Site Geology
Dave Hoover	USGS/GD	Site Geology
Dave Vaniman	LANL	Mineralogy
Schon Levy	LANL	Mineralogy
Dave Bish	LANL	Mineralogy
J. O'Neil	USGS/GD	Isotopes
Joe Downey	USGS/WRD	Paleohydrology
Dale Hammermeister	USGS/WRD	Hydrology/Unsat. flow
Phil Harrold	USGS/WRD	Geomorphology
E. Taylor	USGS/GD	Soils
G. Rush	USGS/WRD	QA
Joe Willmon	USGS/WRD	QA
R. Spengler	USGS/GD	Rock fractures
Ike Winograd	USGS/WRD	Hydrology/geochem.
Platt Bradbury	USGS/GD	Paleoclimate
C. Repenning	USGS/GD	Paleotology
G. Spaulding	Univ Wash.	Paleobotany
Dick Hay	Univ Ill.	Quat. Geology
W. Dort	Univ Kan.	Pollen/phytoliths
Dave Lobmeyer	USGS/WRD	Hydrology
Ed Gutentag	USGS/WRD	Ostracodes
J. Harden	USGS/WRD	soils
Barney Szabo	USGS/GD	Geochronology
John Roshalt	USGS/GD	Geochronology
*hydrochemist(s)	USGS/WRD	Hydrochemistry
*hydrotech	USGS/WRD	Field support
*QA technician	USGS/WRD	Quality Assur.

BUDGET

Estimated for FY 86

ITEM	COST \$
Trenching of spring deposit and trench extension	8000
Reduction of existing geologic information to maps	5000
Field trip and initial planning	12000
Operational travel and field trips	14000
LANL costs, mineralogy, etc	10000
Trench mapping, 1/3-FTE	7000
Studies of Sand Ramp carbonate deposits 1/2FTE-tech	15000
Pollen, phytolith, biological studies	12000
Qual. Assurance/services	17000
Sub-total	100,000
Overhead, 35%	35000
Total 1st year project costs=	\$ 135,000

Paul

Comment Response
appendix = CRA

CURRENT WORK:

- o STABLE ISOTOPES
- o MINERALOGY-FLUID INCLUSIONS
- o GEOCHRONOLOGY

PLANNED WORK:

- o EXPANDED TRENCHING
- o MAPPING
- o SOIL HYDROLOGY
- o SAND RAMPS
- o PALEONTOLOGY

MINERALOGY OF SHALLOW SECONDARY DEPOSITS

- o CALICHE: CALCITE-OPAL-AMORPHOUS SILICA-SEPIOLITE
- o FAULTS : CALCITE-OPAL-AMORPHOUS SILICA-SEPIOLITE
- o ACTIVE SPRINGS: CALCITE
- o PALEOSPRINGS: GYPSUM-CALCITE

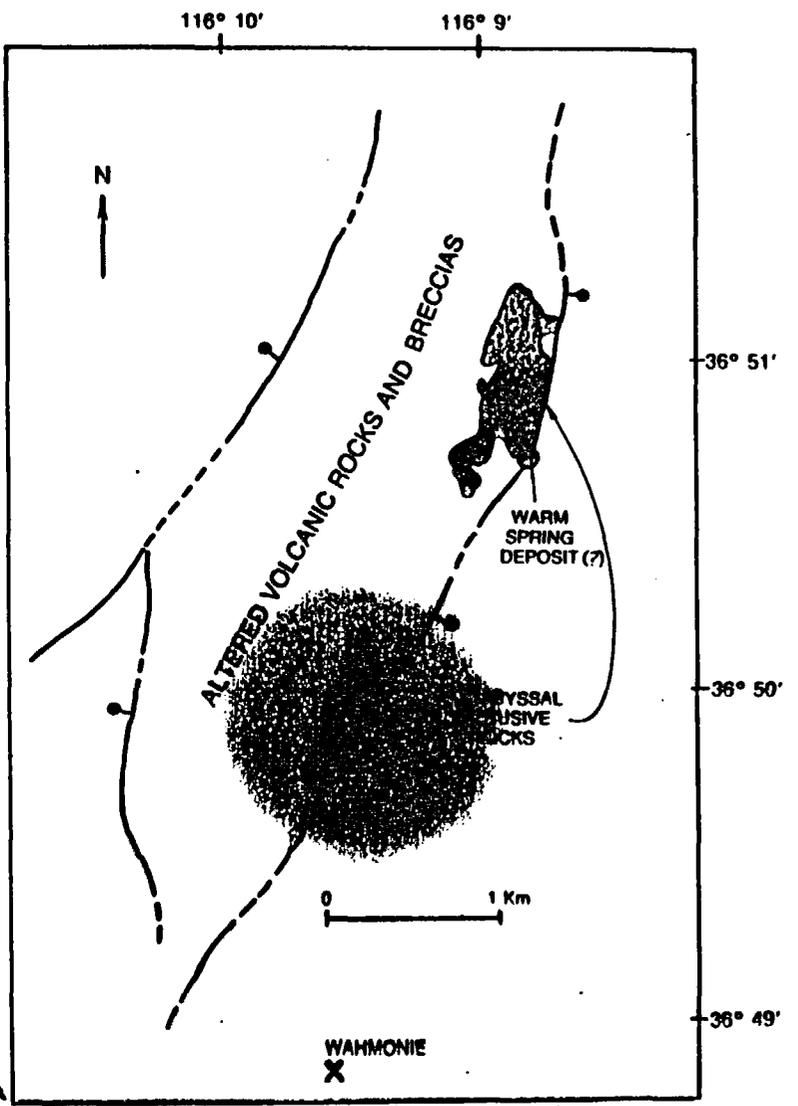
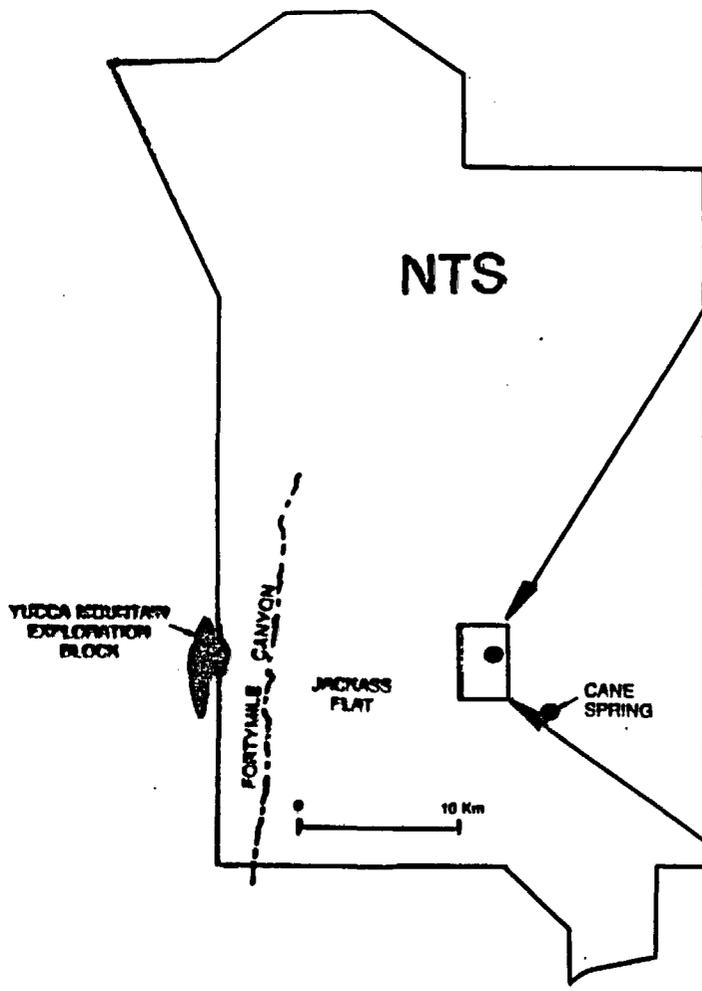


Los Alamos

ORIGINS OF FAULT-RELATED MINERALS EXPOSED IN TRENCHES AT YUCCA MOUNTAIN,
NEVADA

POSSIBLE ORIGINS:	Type 1 Calcite - Silica - Sepiolite	Type 2 Drusy Quartz
1) Pedogenic	?	no (2)
2) Low-T ^o Spring	?	no (2)
3) High-T ^o Spring	no (1), (3)	?
4) Early High-T ^o Alteration	no (1), (3)	?

Sources of data: (1) mineralogy
(2) fluid-inclusion bubble homogenization temperatures
(3) carbon and oxygen isotopes



ZZSHT



PROJECT

OXYGEN ISOTOPE RATIOS: CALCITE

	$\delta^{18}\text{O}^*$ SMOW	$T^\circ\text{C}^\dagger$
<u>Trench 14</u>		
T14-FB (calcite in fault)	19.6	
TR-14-3a-w (tuff replacement?)	20.3	~ 5
<u>Eran Ridge</u>		
FR6 (soil caliche)	19.8	
SILICA PLUS CALCITE		
<u>Trench 14</u>		
T14-FA (amorphous silica in fault)	27.2	
T14-FB (calcite in fault)	19.6	

Analyses by J. R. O'Neil, USGS

[†] For ground water with $\delta^{18}\text{O} = -13.0$;

see Javoy (1973)

Los Alamos

**ZZ
SOIL
PROJECT****OXYGEN ISOTOPE RATIOS: SILICA**

	$\delta^{18}\text{O}$ * smow	T°C †
<u>Trench 14</u>		
T14-FA (amorphous silica)	27.2	~ 15
TR-14-3a-q (drusy quartz)	22.1	50
<u>Secondary silica in Tpt lower vitrophyre</u>		
YF-4-q (drusy quartz)	37.8	70
YW-4-q (chalcedony)	19.1	100
VH-2-3545-q (drusy and microquartz)	13.0	100

Analyses by J. R. O'Neil, USGS

For ground water with $\delta^{18}\text{O} = -13.0$;
Bottinga and Javoy (1973)

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DISQUALIFICATION

A SITE SHALL BE DISQUALIFIED IF THE PRE-WASTE-EMPLACEMENT GROUND-WATER TRAVEL TIME FROM THE DISTURBED ZONE TO THE ACCESSIBLE ENVIRONMENT IS EXPECTED TO BE LESS THAN 1000 YEARS ALONG ANY PATHWAY OF LIKELY AND SIGNIFICANT RADIONUCLIDE TRAVEL.

10CFR960.4-2-1(d)

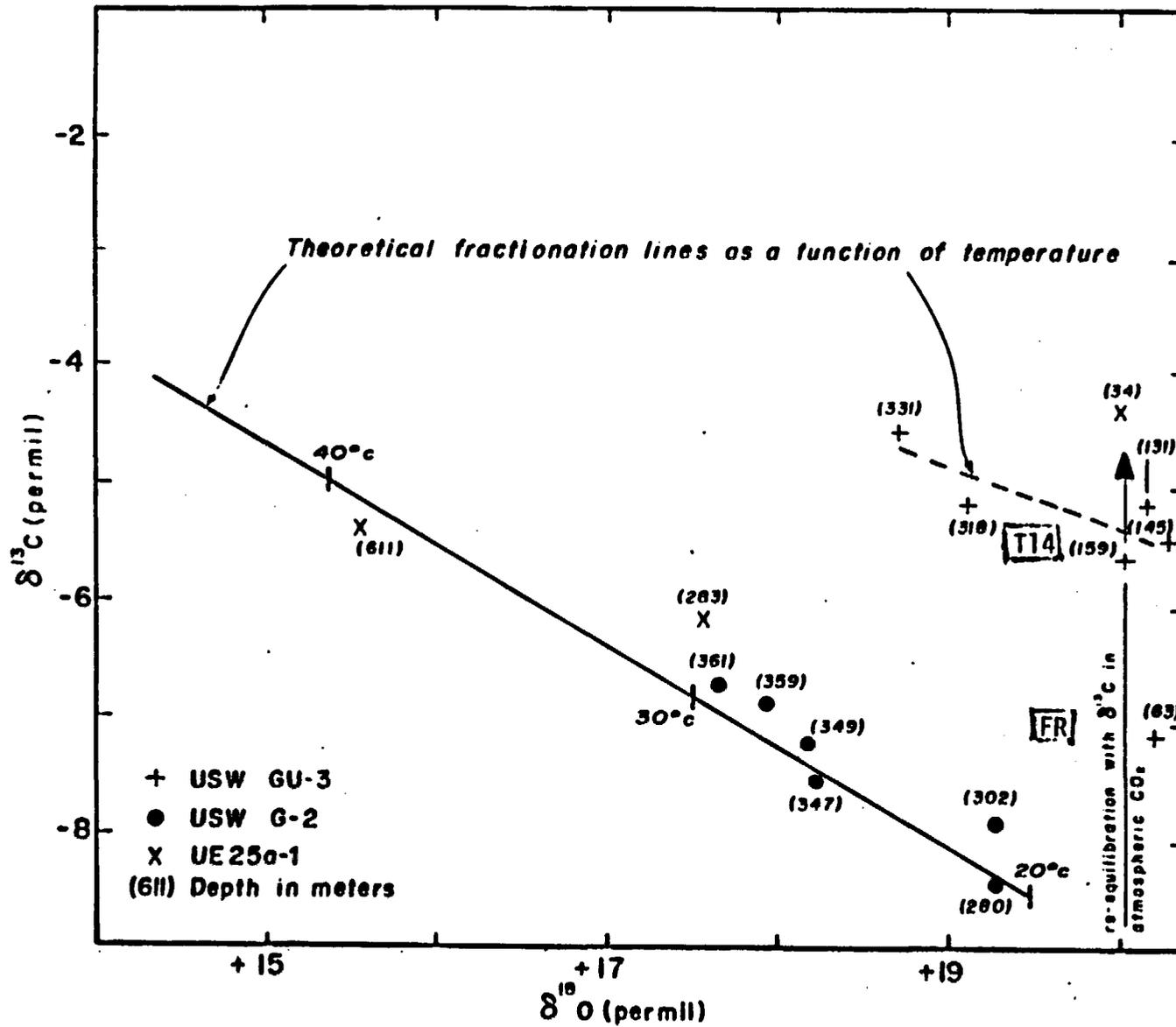


Figure from Scott and Castellanos, 1984
(USGS OFR 84-491)



EA STATUS

PROGRESS SINCE MAY 29

- RESULTS OF TOC MEETING MAY 28-30
- DRAFT CRA TO HQ JUNE 3
- HQ WORKSHOP JUNE 11-13
- STATE CLARIFICATION MEETING JUNE 21

NEW EA SCHEDULE

- INTERIM GUIDANCE
- OVERALL SCHEDULE

STATUS OF COMMENT RESPONSE

- RESPONSE STATUS
- UNRESOLVED ISSUES

REMAINING UNCERTAINTIES

- END OF COMMENT PERIOD
- ISSUE RESOLUTION MEETINGS
- "FLOATING" COMMENTS



EA STATUS

RESULTS OF TOC MEETING MAY 28-30

- DID NOT PERFORM A TECHNICAL/POLICY REVIEW OF THE 6-3 DRAFT CRA
- ISSUED GUIDANCE TO TECHNICAL STAFF RESPONSIBLE FOR COMMENT RESPONSE
- ISSUED GUIDANCE TO COMMENT MONITORS RESPONSIBLE FOR ISSUE RESPONSES
- DRAFTED COVER LETTER FOR CRA AND A STATEMENT OF NNWSI PROJECT'S ABILITY TO SATISFY OBJECTIVES OF THE HQ WORKSHOP JUNE 11-13



EA STATUS

Comment Response Appendix

DRAFT CRA TO HQ JUNE 3

- CONTAINED ISSUE RESPONSES TO APPROXIMATELY 30% OF COMMENTS RECEIVED BY MAY 6
- COMPLIED WITH HQ REQUEST FOR A STATUS DRAFT
 - RECEIVED AT HQ ON JUNE 3
 - ALLOWED DECISIONS ON FORMAT, TOC
 - INFORMED HQ WORK GROUPS ON COMMENT RESOLUTION AND FINDINGS



EA STATUS

HQ WORKSHOP JUNE 11-13

● WORKGROUPS

- SITING PROCESS
- ENVIRONMENTAL
- SOCIOECONOMIC
- TRANSPORTATION
- GEOSCIENCES
 - GEOHYDROLOGY
 - GEOCHEMISTRY
 - ROCK CHARACTERISTICS
 - TECTONICS
- REPOSITORY DESIGN
- PERFORMANCE ASSESSMENT

● STEERING GROUP



EA STATUS

HQ WORKSHOP JUNE 11-13

- WORK GROUPS
- STEERING GROUP
 - PRODUCTION COORDINATION
 - INCORPORATE ADEQUATE PRODUCTION TIME IN SCHEDULE
 - EXECUTIVE SUMMARIES
 - HQ & PO TO SPLIT RESPONSIBILITIES
 - FORMAT FOR CRA
 - GUIDANCE FROM NNWSI TOC & HQ FORMAT
 - CLOSE OF PUBLIC COMMENT PERIOD
 - CONTINUE TO ACCEPT COMMENTS
 - COMMENTS APPLICABLE TO MORE THAN ONE SITE
 - RELATES TO SALT SITES
 - COMMENTER INDEX FOR CRA
 - FORMAT/CONTENT
 - CHAPTER 7 METHODOLOGY
 - EA SCHEDULE CONSISTENT WITH BENNETT MEMO
 - EA FINALIZATION SCHEDULE
 - PO PROPOSED DATES: DRAFT CRA 8-15
 - "FINAL" EA/CRA 11-1
 - CAMERA-READY COPY 1-3
 - CONCURRENCE REVISIONS 1-31
 - PUBLICATION 2-21



EA STATUS

STATE COMMENT CLARIFICATION MEETING
JUNE 21

- ATTENDEES
 - PO BLANCHARD, FOLEY
 - HQ GALE, BENSON, DORSHEIMER
 - NV LOUX, JOHNSON, STROLIN

- 23 QUESTIONS ASKED COVERING A BROAD SPECTRUM OF DISCIPLINES

- RESULTED IN __ ADDITIONAL COMMENTS



EA STATUS

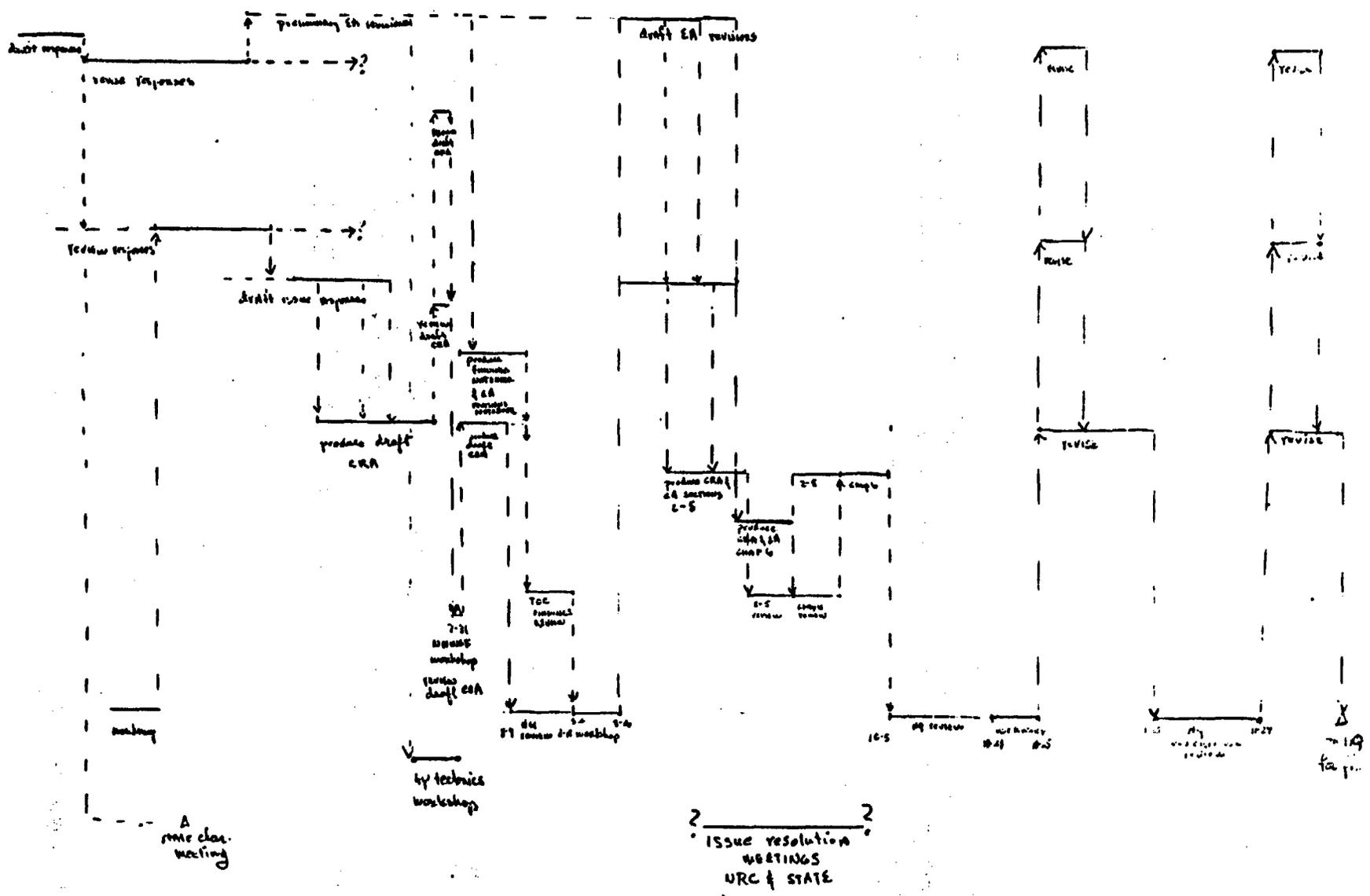
NEW EA SCHEDULE

- VERBAL DIRECTION FROM HQ 6-20
 - DRAFT CRA 8-8
 - HQ REVIEW CRAS 8-9 TO 8-19
 - HQ WORKSHOP 8-20 TO 8-23
 - REVISE CRA & EA 8-24 TO 10-4
 - HQ REVIEW CRA & EA 10-5 TO 10-21
 - HQ WORKSHOP 10-22 TO 10-24
 - CAMERA READY 11-15
 - HQ REVIEW 11-15 TO 11-29
 - CONCURRENCE REVISIONS 12-6
 - TO PRINTER 12-6
 - ISSUE FINAL EAS 12-20

- NNWSI INTERIM EA SCHEDULE
 - TECHNICAL STAFF COMPLETE COMMENT RESPONSES BY 7-1
 - COMMENT MONITORS TO WRITE ISSUE RESPONSES
 - JOINT TECHNICAL STAFF & COMMENT MONITOR CRA REVIEW ON 7-31

3 10 17 24 31
 3 10 17 24 31 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9

TECHNICAL STAFF



A time class meeting

ISSUE RESOLUTION MEETINGS URC & STATE



EA STATUS

STATUS OF COMMENT RESPONSE

- RESPONSE STATUS
- UNRESOLVED ISSUES
 - TECTONICS RESPONSE
 - WASTE PACKAGE/GEOCHEMISTRY INTERACTION
 - REPOSITORY EMPLOYMENT JUSTIFICATION
 - REVISION OF SECTION 4.1
 - PERFORMANCE ASSESSMENT TIES FOR 33 GUIDELINES
(NEED GEOHYDROLOGY INFORMATION)
 - POLICY COMMENTS
 - + AIR FORCE
 - + WEAPONS TESTS
 - + WATER RIGHTS
 - + LAND ACQUISITION



EA STATUS

REMAINING UNCERTAINTIES

- END OF COMMENT PERIOD

- ISSUE RESOLUTION MEETINGS
 - NOT SCHEDULED
 - REQUIRES STAFF FOR PREPARATION & ATTENDANCE
 - EXPECTED TO RESULT IN ADDITIONAL COMMENTS

- "FLOATING" COMMENTS

- STAFF CONFLICTS
 - SCP
 - NRC WORKSHOPS
 - EA

**EARNED VALUE AGENDA
TPO MEETING 6/26/85
10:15 - 11:00**

- 1. REVIEW OF FINDINGS FROM FINAL REPORT (10 MINS)**
 - o SYSTEM IMPACT FACTORS
 - o RESULTS OF PARTICIPANT COST ESTIMATE
 - o PIVOTAL ISSUES
 - o WMPO CONCURRENCE

- 2. DISCUSSION OF IMPLEMENTATION PLAN (15 MINS)**
 - o SEQUENCE OF EVENTS
 - TRAINING AND SUPPORT TO BE PROVIDED IN
AUG./SEPT. PERIOD
 - COST ACCOUNT PLANS
 - COST PERFORMANCE REPORT

 - o BUDGET PLANNING - IF FINAL FY 86 BUDGET NOT AVAIL-
ABLE BY MID SEPTEMBER - NNWSI PROJECT TO ESTABLISH
INTERIM BUDGET/BASELINE FOR 1ST 4 MONTH PERIOD

 - o SOFTWARE SUPPORT - PROGRAMS BEING WRITTEN BY SAIC

- 3. STATUS REPORT FROM TPO'S**

U.S. DEPARTMENT OF ENERGY

O
C
R
W
M
OGR

Nevada
Nuclear
Waste
Storage
Investigations
PROJECT

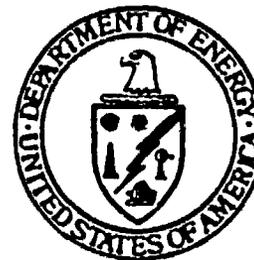


Performance Measurement System study

FINAL REPORT

June 8, 1985

NEVADA OPERATIONS OFFICE
U.S. Department of Energy



**FACTORS AFFECTING THE IMPACT OF THE
PROPOSED NNWSI PROJECT APPROACH**

- **NUMBER OF TASKS TO BE HANDLED AS NON-LOE**
- **NUMBER OF NEW SYSTEM REQUIREMENTS (FORMS)**
- **LEVEL OF SUPPORT TO COME FROM TECHNICAL AND
MANAGEMENT SUPPORT SERVICES (T&MSS CONTRACTOR (SAIC))**
- **NUMBER OF PERFORMANCE MEASUREMENT SYSTEM PROCESSES
THAT ARE ALREADY IN PLACE**
- **NUMBER OF RESOURCE PRIORITY SHIFTS**

REVISED ACTIVITY STANDARDS

<u>OUTPUT</u>	<u>TASK</u>	<u>AVERAGE MANDAYS / PARTICIP.</u>
WBS	REVISE FOR NEW COST ACCOUNTS (CA'S)	7
WBS DICTIONARY	REVISE FOR NEW COST ACCOUNTS	1.6 PER CA
ORG STRUCTURE	REVISE FOR NEW COST ACCOUNT MANAGERS (CAMS)	15
CAP	PREPARE FOR DISCRETE CA	4.7 PER CA
NETWORKS	NEW MILESTONES FOR DISCRETE COST ACCOUNTS	21 PER CA
(DATA PROCESS)	ACCOUNTING SYSTEM SUMMARY	8.4
(STATUS INPUT)	UPDATE PROGRESS ON DISCRETE COST ACCOUNTS	.6 PER CA/MO
VAR (& REVIEW)	REVIEW DATA AND COMPLETE VAR'S	.75 PER CA/MO
CHANGE METHODS	INCORPORATE CHANGES AS REQUIRED	7 PER CA
TRAINING SESSIONS	EV TRAINING FOR CAMS	1.5 PER CAM
DOCUMENTATION		9

REVISED SUMMARY OF COSTS

NNWSI PROJECT PERFORMANCE MEASUREMENT APPLICATIONS
IMPACT ESTIMATE IN MANDAYS

CRITERIA CATEGORY	OUTPUT	85 PARTIC/T&MSS		86 PARTIC/T&MSS	
ORGANIZ.	WBS	34	36	35	40
	WBS DICTION.	--	--	68	44
	ORG STRUCT.	66	20	50	20
PLANNING & BUDGETING	CAP	213	104	200	100
	NETWORKS	783	128	800	400
ACCOUNTING	(DATA PROCESSES)	127	202	125	316
ANALYSIS (REPORTING)	(STATUS INPT)	---	---	324	204
	VAR (+REVW)	---	---	224	228
REVISIONS	CHANGE METHODS	---	---	389	236
DOCUMEN- TATION	SYS DESCR	}	226	116	524
	OPER PROC				
	USER HDBKS				
TRAINING	TRAIN. MAT'L	}	60	150	192
	TRAIN. SESS				
		1376	776	2481	2304

- o ASSUMES SAIC VALIDATION IN FY 86
- o ASSUMES 20% AVG MIN NON-LOE IN FY 86

COMPARISON OF FY 86 ESTIMATES TO FY 86 WPAS

	<u>PERFORMER</u>	<u>ESTIMATES FROM EV STUDY</u> (\$K)	<u>WPAS BUDGETS FOR EV SYSTEM</u> (\$K)
DEVELOPMENT, MAINTENANCE, AND ANALYSIS OF PROJECT NETWORK PLANS AND SCHEDULES FOR EACH WBS ELEMENT AND OVERALL PROJECT BY T&MSS	(SAIC)	339	350
PROGRAM MANAGEMENT SYSTEM DEVELOPMENT, MAINTENANCE, AND ANALYSIS OF NETWORK PLANS AND SCHEDULES FOR MAJOR PROJECT ACTIVITIES AS EA, SCP, ETC.	(SAIC)	213	200
SAIC EARNED VALUE OPERATIONS, TRAINING, AND DOCUMENTATION FOR T&MSS INCLUDING PREPARATION FOR C/SCS VALIDATION.	(SAIC)	860	900
NNWSI PROJECT EARNED VALUE OPERATIONS BY SNL, LANL, AND USGS	(SNL, USGS, LLNL, LANL)	855	800
EARNED VALUE TRAINING AND SYSTEM DOCUMENTATION BY SNL, LLNL, LANL, AND USGS.	(SNL, USGS, LLNL, LANL)	<u>211</u>	<u>900</u>
TOTAL		2,478	3,150

PIVOTAL ISSUES

- **PRECEDENT FOUND IN COMPARABLE APPLICATIONS**
- **NO INSURMOUNTABLE ISSUES OR CONCERNS**
- **CAN BE IMPLEMENTED AND MAINTAINED AT A REASONABLE COST**

**FY 86 PERFORMANCE MEASUREMENT
BASELINE DEVELOPMENT SCHEDULE**

	IDEAL <u>DATE</u>	DROP-DEAD <u>DATE</u>
1. IDENTIFY COST ACCOUNTS	9/1/85	9/27/85
2. PREPARE COSE ACCOUNT PLANS	9/27/85	10/25/85

