

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
PANEL ON STRUCTURAL GEOLOGY & GEOENGINEERING**

**SUBJECT: UPDATE ON SURFACE-BASED
TESTING**

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**ARLINGTON, VA
JANUARY 7-8, 1992**

Site Characterization Consists of Surface, Underground and Laboratory Testing

**Although budgetary constraints preclude
an aggressive ESF Program in FY 92,
demonstrable progress can be obtained
through selective surface-based testing**

Surface-Based Testing for FY92 Focuses on:

- **Suitability Issues (liquid and gaseous flow model testing)**
- **Environmental prerequisites**
- **Issue Resolution**
- **ESF prerequisites**
- **Logical precursor activities**

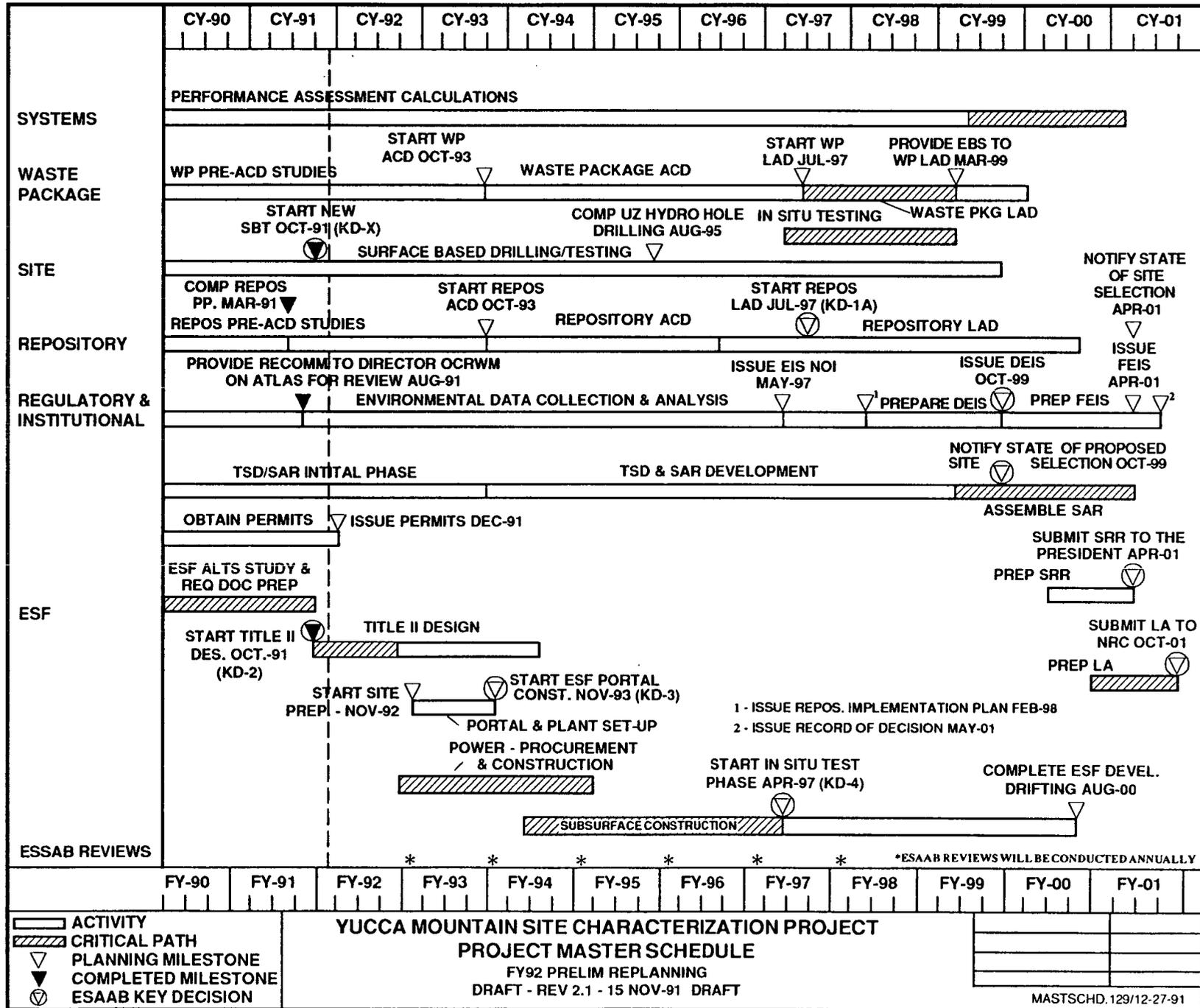
Presentation Topics

- **Total surface-based testing program**
 - **Through FY 2001**
- **FY 1992 testing activities**
- **Test planning process**
- **Conclusion**

Total Surface-Based Testing Program
(Through FY 2001)

Current YMP Working Schedule

AS OF
15 DEC 91



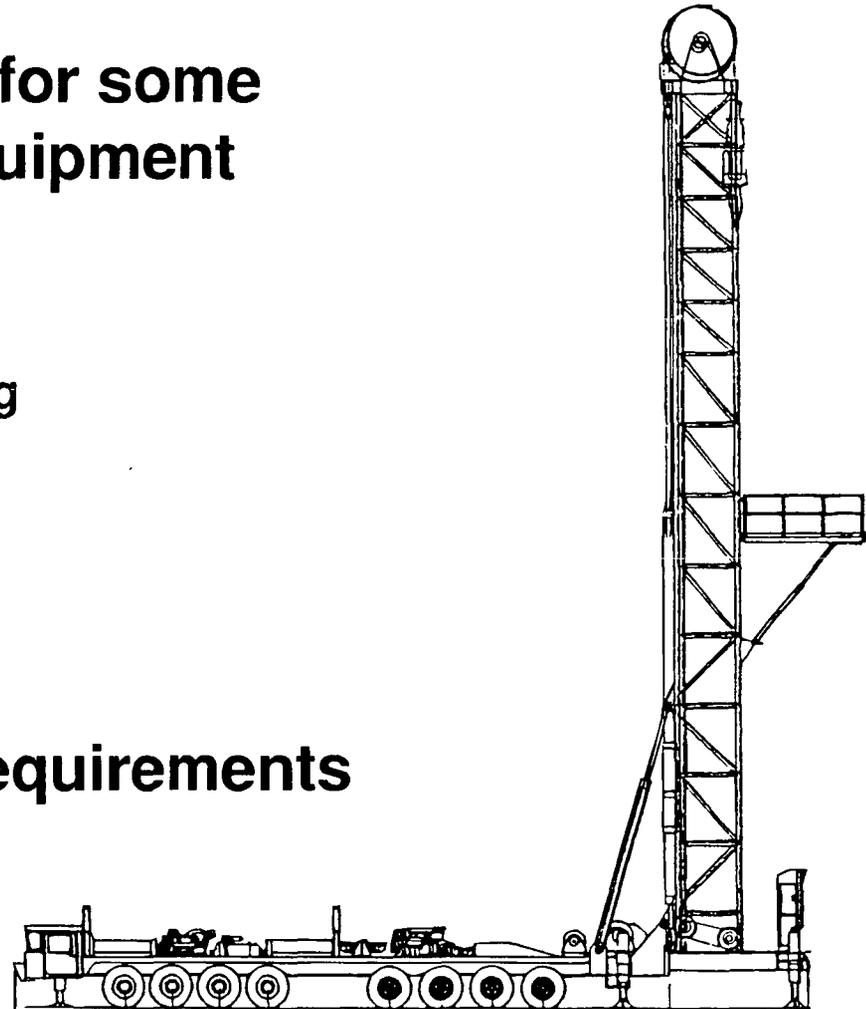
- [] ACTIVITY
- [Hatched] CRITICAL PATH
- [▽] PLANNING MILESTONE
- [▼] COMPLETED MILESTONE
- [⊙] ESAAB KEY DECISION

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
PROJECT MASTER SCHEDULE
 FY92 PRELIM REPLANNING
 DRAFT - REV 2.1 - 15 NOV-91 DRAFT

Major Challenges

Procurement is required for some surface-based testing equipment

- **Unique**
 - LM-300 dry coring/drilling rig
- **Technically complex**
 - UZ monitoring equipment
- **Compliance with QA requirements must be documented**



The Surface-Based Investigations Include a Suite of Activities

- **280 Shallow drillholes**
- **150 Deep drillholes**
- **95 Trenches/test pits**
- **44 Geophysical surveys**
- **Accompanying geologic mapping and laboratory studies**
- **Some of these activities are underway**

FY 1992 Testing Activities

Surface-Based Testing for FY92 Focuses on:

- **Suitability Issues (liquid and gaseous flow model testing)**
- **Environmental prerequisites**
- **Issue Resolution**
- **ESF prerequisites**
- **Logical precursor activities**

Suitability Issues

- **Unsaturated zone infiltration (neutron holes)**
- **Gaseous-phase movement in the unsaturated zone (UZ-9)**
- **Liquid-phase movement in the unsaturated zone (UZ-16)**

Preliminary Results from Unsaturated Zone Infiltration Studies

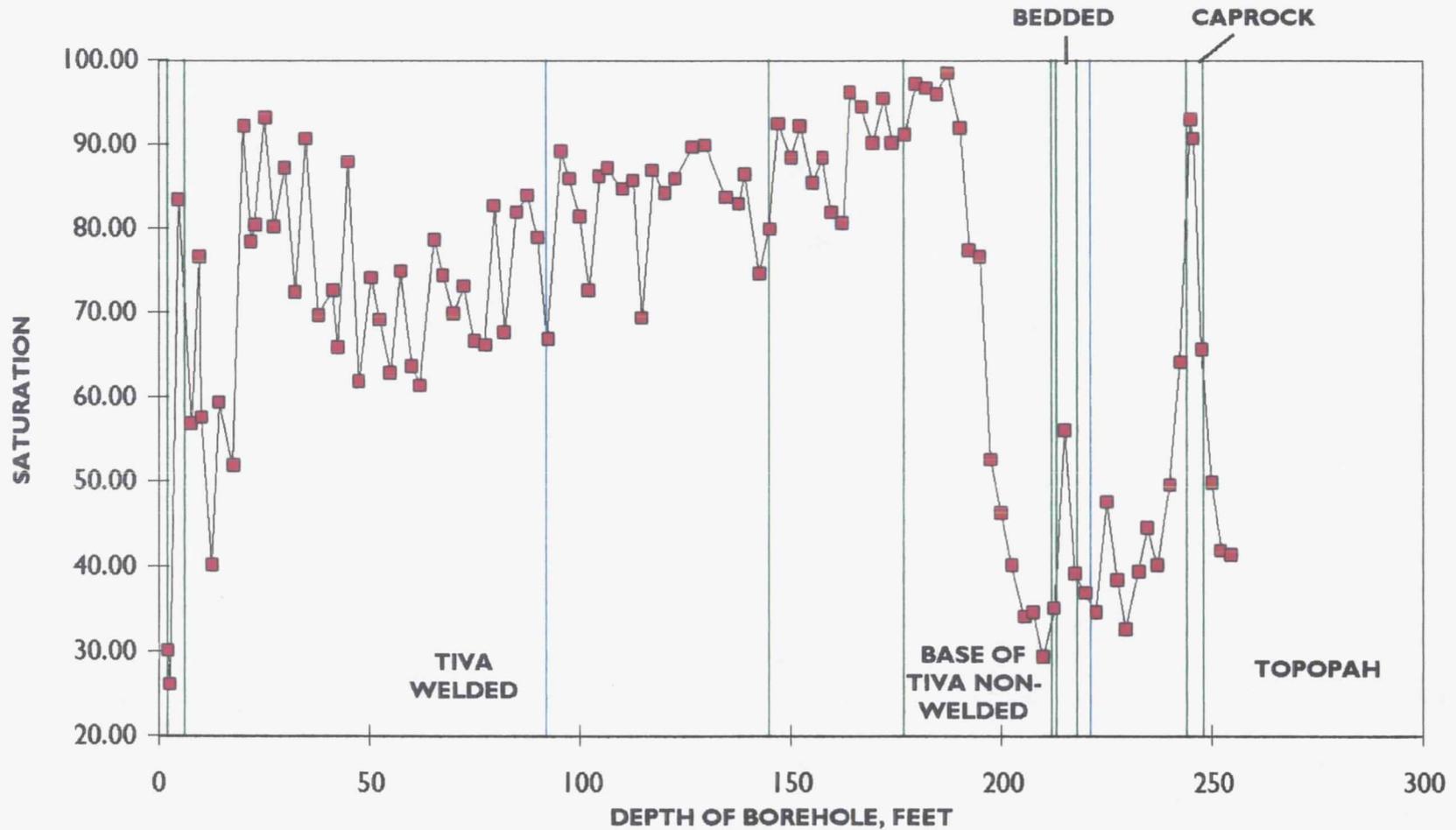
- **24 planned neutron holes (shallow boreholes)**
 - 12 sited
 - 2 completed to approximately 250 feet
- **Results to date allow validation of volumetric water content data acquired since 1985 in 75 existing neutron boreholes, and in existing uncased boreholes such as UZ-4, 5, 6, 7, 8 and 13**

Preliminary Results from Unsaturated Zone Infiltration Studies

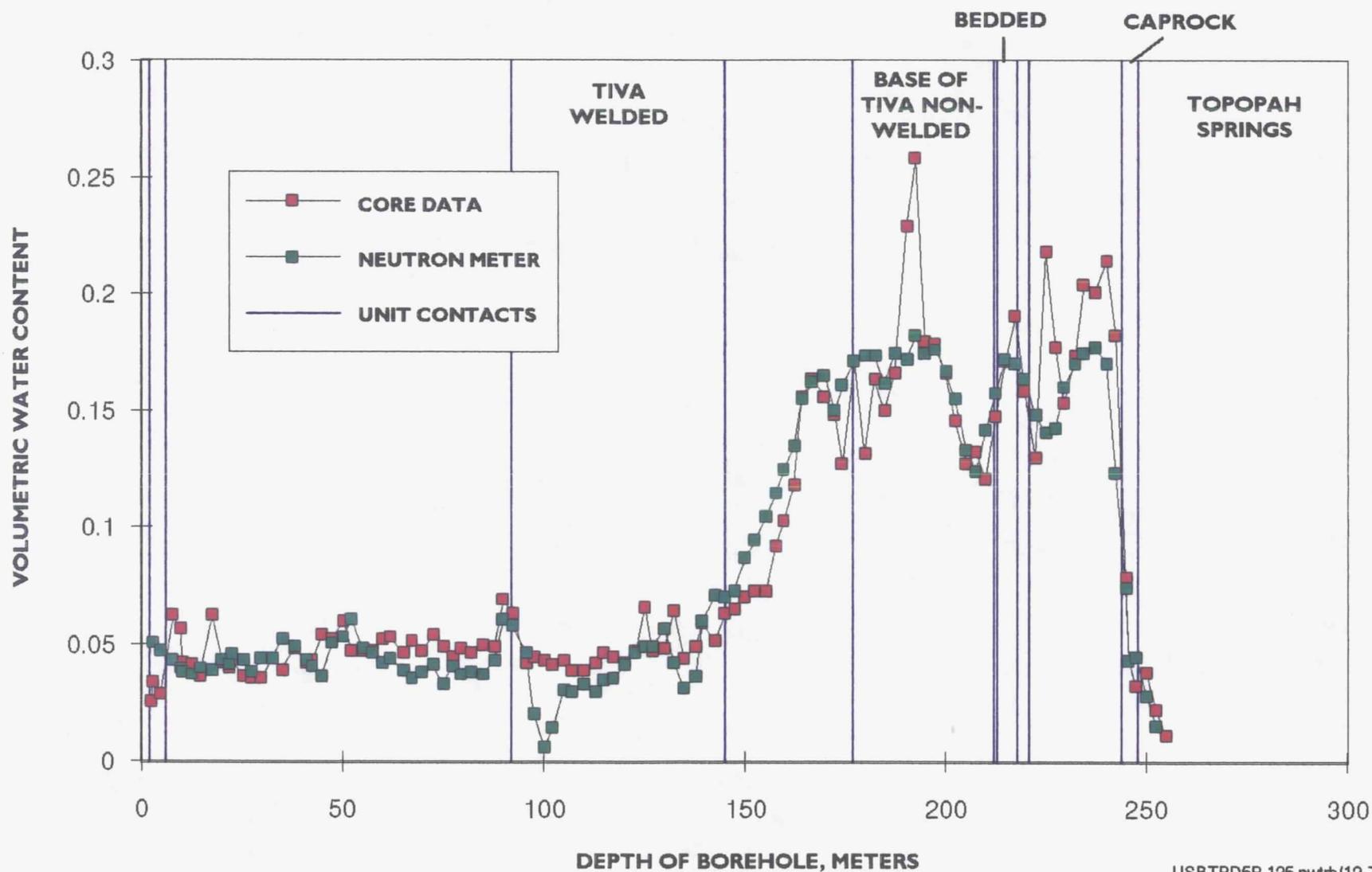
(cont'd)

- **The high saturation at the top of the nonwelded Paintbrush Tuff followed by a gradual decrease suggests that water flow in fractures in the overlying welded Tiva Canyon has transitioned into matrix flow, which argues against a conceptual model involving throughgoing fracture pathways**
- **The high saturation in the top of the nonwelded Paintbrush Tuff appears to be associated with high clay content which may have implications for the underground excavation activities**
- **Detailed core analysis at close spacing has allowed for a major improvement in modeling water flow at the site**

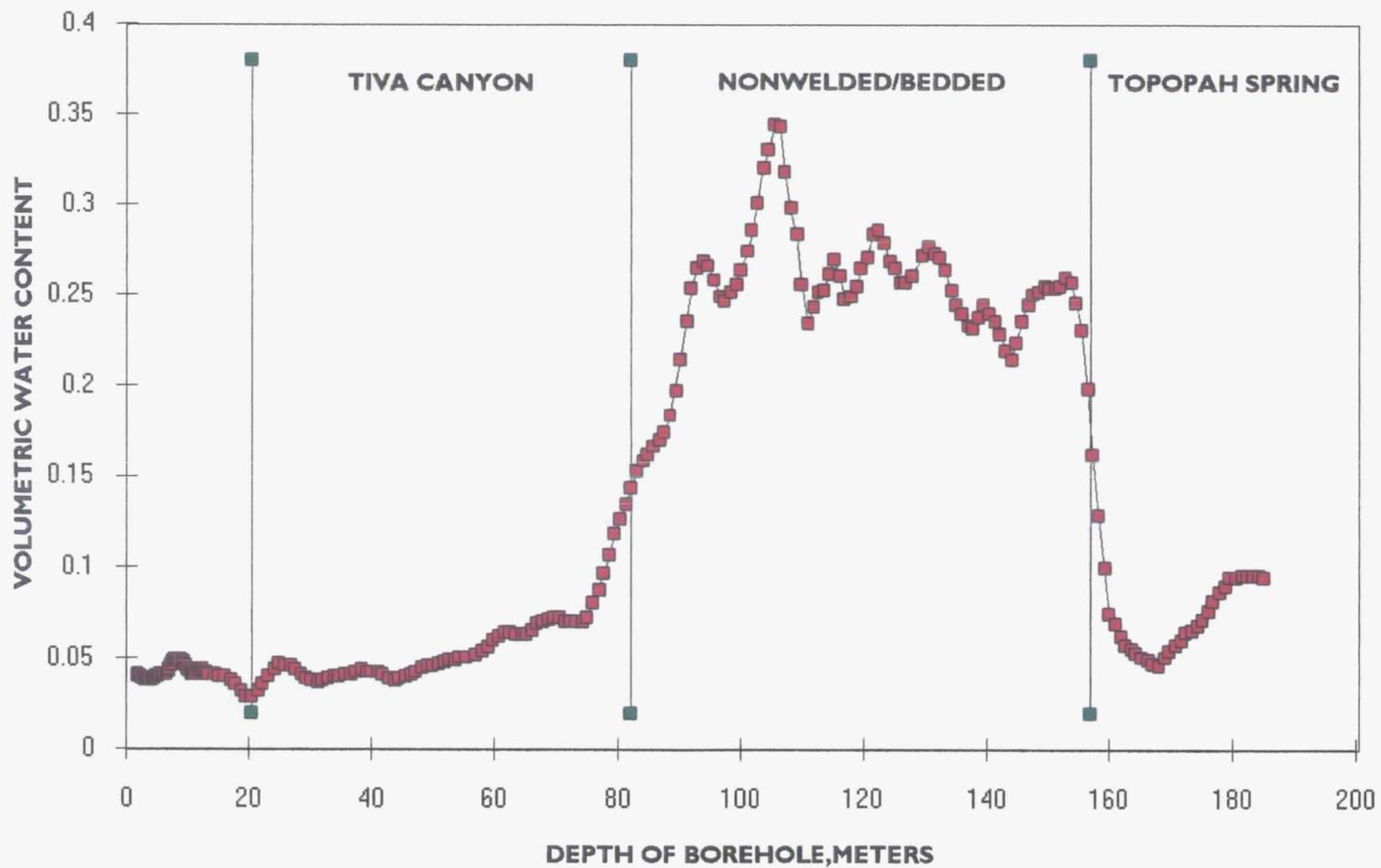
USW UZN - 55, % Saturation



Preliminary Results From Neutron Calibration



USW UZ-7 Pre-existing open borehole



Environmental Prerequisites

- **Environmental Monitoring Well (JF-3)**
- **Addresses concern of National Park Service regarding rate of water withdrawal**

Issue Resolution

- **Volcanism Studies**
- **Closure of erosion issue**
- **Closure of calcite/silica issue
(Trench 14)**

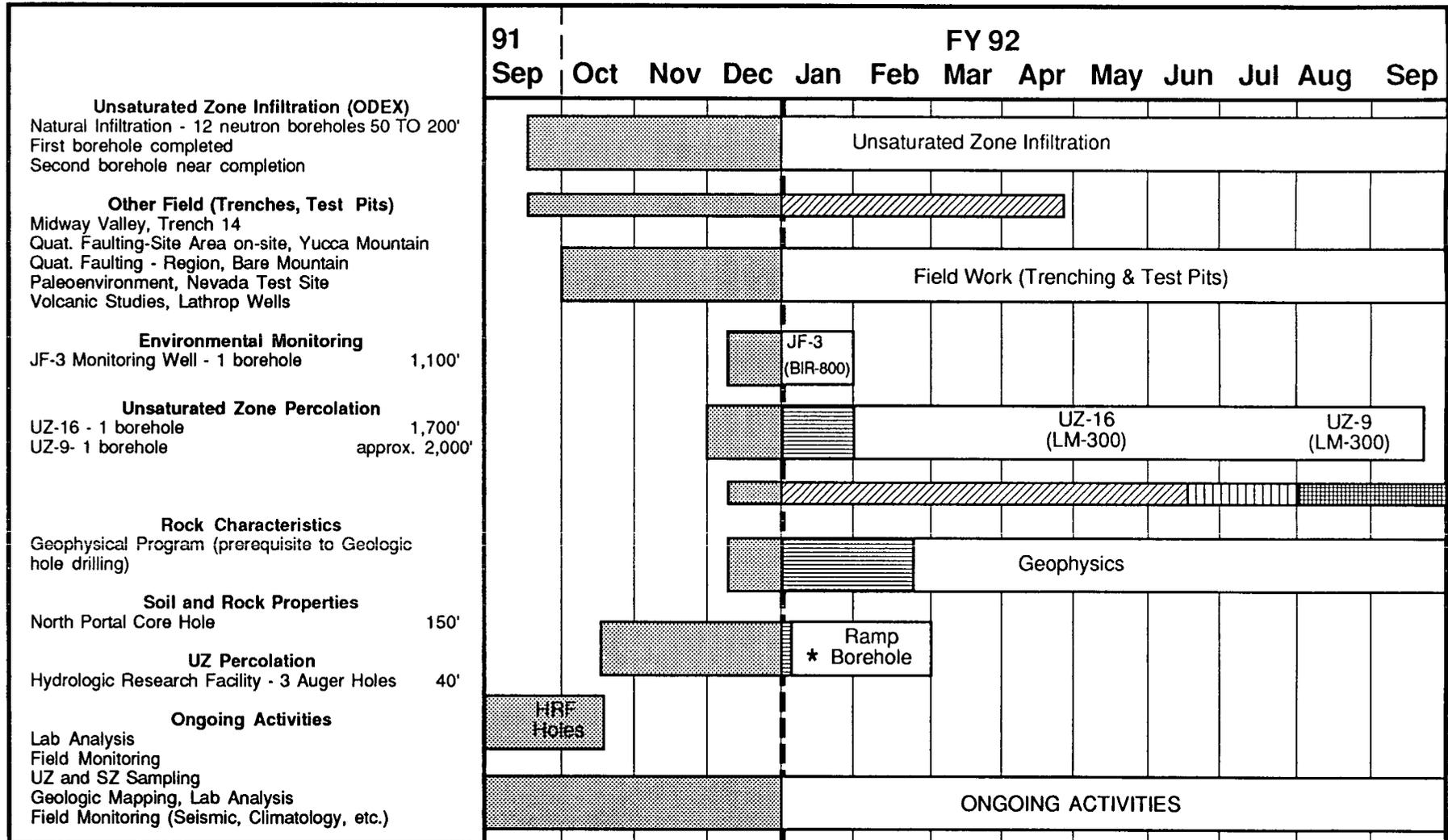
ESF Prerequisites

- **Soil and rock properties and ramp boreholes**
- **Southern environmental monitoring station**

Logical Precursors to Other Activities

- **Surface facility trenching (prior to pad construction)**
- **Geophysical surveys (prior to G-5)**

FY 1992 Surface Disturbing Activities



RIG WORK SCHEDULE

Status as of: 12/24/91

Work Complete



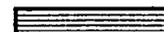
8 Hours/Day, 5 Days/Week



16 Hours/Day, 5 Days/Week



24 Hours/Day, 5 Days/Week



PREREQUISITE COMPLETION
 SCHEDULE TBD

*

Surface-Disturbing Tests (Page 1 of 3)

WBS#	DESCRIPTION	STUDY PLAN#	WORK TO BE DONE
* 1.2.3.2	Characterization of vertical/ lateral distribution of stratigraphic units in site area	8.3.1.4.2.1	3 G-holes, Stratmaster, 5000', mapping, geophysics
	Characterization of structural features within site area	8.3.1.4.2.2	Mapping
*	Systematic acquisition of site-specific subsurface information	8.3.1.4.3.1	SD holes (12), LM-300, 2600'
△	Distribution & characterization of present & past erosion	8.3.1.6.1	Mapping of Yucca Mountain & Fortymile Wash
*	Characterization of volcanic features	8.3.1.8.5.1	4 drillholes, Joy 2 rig, 1000',V Mapping, sampling, soil test pits
	Characterization of igneous intrusive features	8.3.1.8.5.2	Mapping
	Invest. folds in Miocene & younger rocks of the region	8.3.1.8.5.3	Mapping
*	Soil & rock properties ESF	8.3.1.14.2.1	Drill exploratory boreholes along ESF ramp alignments Trenches, test pits at ESF surface facilities locations
	Characterization of site ambient thermal conditions	8.3.1.15.2.2	Drill 2 boreholes to at least 1300'

* Major FY92 activity △ Candidate for issue resolution

Surface-Disturbing Tests (Page 2 of 3)

WBS#	DESCRIPTION	STUDY PLAN#	WORK TO BE DONE
*	Location & recency of faulting near prospective surface facility	8.3.1.17.4.2	Trenching, mapping
	Quaternary faulting within 100KM of Yucca Mountain including Walker Lane	8.3.1.17.4.3	Mapping, geophysical studies, 2 trenches
	Quaternary faulting proximal to site within NE-trend fault zone	8.3.1.17.4.4	Mapping, 1 trench
	Detachment faults at or proximal to Yucca Mountain	8.3.1.17.4.5	Mapping
*	Quaternary faulting within the site area	8.3.1.17.4.6	Mapping, 6 trenches
	Stress field within/proximal to site area	8.3.1.17.4.8	Mapping, in situ stress measurements
	Tectonic geomorphology of Yucca Mountain region	8.3.1.17.4.9	Mapping
	Geodetic leveling	8.3.1.17.4.10	Surveying of erosion
1.2.3.3	Characterization of regional ground waterflow system	8.3.1.2.1.3	H holes, #TBD
*	Characterization of UZ infiltration	8.3.1.2.2.1	UZN holes, ODEX 20-300', logging

* Major FY92 activity

Surface-Disturbing Tests (Page 3 of 3)

WBS#	DESCRIPTION	STUDY PLAN#	WORK TO BE DONE
* 1.2.3.3	Characterization of percolation in UZ-surface based investigation	8.3.1.2.2.3	Drill 17 UZ holes, LM-300,60-610M, UZ-16 (VSP-1)
	Characterization site saturated zone ground water flow system	8.3.1.2.3.1	Drill 8 WT holes (3000'), WT
* 1.2.3.5	Environmental monitoring		JF-3 near J-12, NTS rig
	Natural infiltration drillholes & construction in the UZ	8.3.1.2.2.1	UZN holes, Odex 20-300'
1.2.3.6	Paleoclimate study: Lake, Playa, Marsh deposits	8.3.1.5.1.2	Trenching, drill to 100'
	Analysis Paleoenvironmental history of Yucca Mountain	8.3.1.5.1.4	Trenching, shallow drilling to 100', mapping
	Char. of the quaternary regional hydrology	8.3.1.5.2.1	Trenching #14, core to 50'

* Major FY92 activity

Non-Surface-Disturbing Tests (Page 1 of 2)

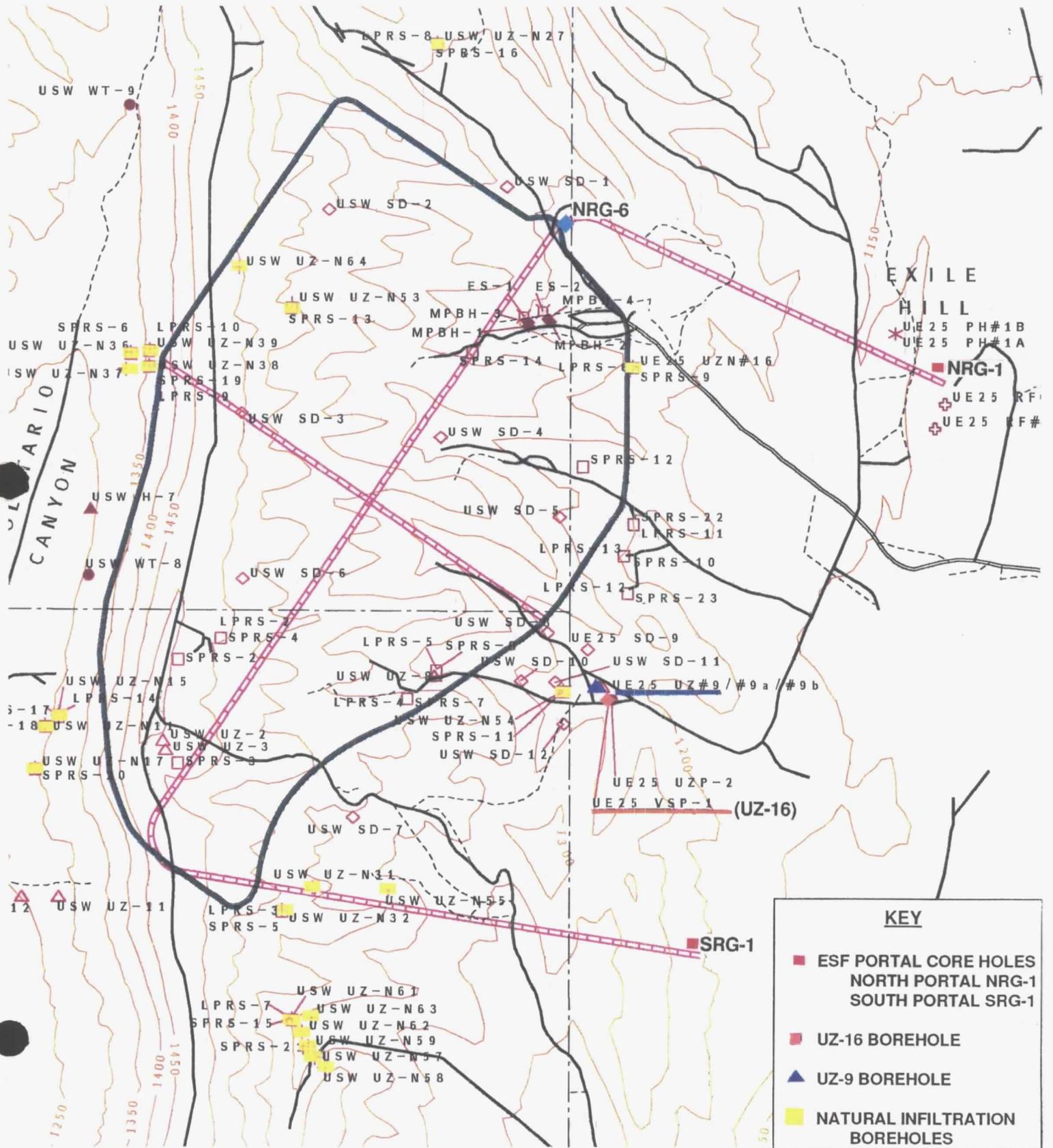
WBS#	DESCRIPTION	STUDY PLAN#	WORK TO BE DONE
1.2.3.2	Mineralogy, Petrology & Chemistry of transport pathways	8.3.1.3.2.1	Samples collected from previous holes
	History of mineralogical & Geochemical alteration of Yucca Mountain	8.3.1.3.2.2	Sampling from ESF
	Probability of volcanic eruption penetrating the repository	8.3.1.8.1.1	Analyses
	Historical & current seismicity	8.3.1.17.4.1	Synthesis of Data
	Subsurf Geometry & concealed extension of quat faulting	8.3.1.17.4.7	Seismic reflection & other surveys
1.2.3.3	Characterization of meteorology for regional hydrology & meteorological monitoring	8.3.1.2.1.1	20 stream monitoring stations
	Characterization of runoff & stream flow	8.3.1.2.1.2	24 monitoring stations
	Water movement tracer tests CI & CI-36 measurements	8.3.1.2.2.2	Tests on UZ samples previously collected

Non-Surface-Disturbing Tests (Page 2 of 2)

WBS#	DESCRIPTION	STUDY PLAN#	WORK TO BE DONE
*	Characterization gaseous-phase movement in UZ	8.3.1.2.2.6	Gas sampling, tracer tests in UZ boreholes
*	Hydrochemical characterization of UZ	8.3.1.2.2.7	UZ gas & water sampling, water geochemical tests
	Determine preclosure hydrologic conditions UZ, Yucca Mountain	8.3.1.16.3.1	Data Compilation
	Characterization of flood potential at Yucca Mountain site	8.3.1.16.1.1	2 stream gages
* 1.2.3.6	Meteorological data collection at Yucca Mountain site	8.3.1.12.1.1	5 meteorological monitor stations
	Characterization of modern regional climate	8.3.1.5.1.1	Weather stations
1.2.3.7	Natural resource assessment of Yucca Mountain, Nye County	8.3.1.9.2.1	Sampling

* Major FY92 activity

YUCCA MOUNTAIN PROJECT PROPOSED DRILLHOLES AND SUBSURFACE ACCESS DRIFTS



Exploration Drill Holes - North Ramp Portal Exploratory Studies Facility - Yucca Mountain Project

Number	Depth	Angle from Vertical	Core	Approximate Coordinates*	Location	Purpose
UE25 - NRG - 1	150 ft	0°	0 - 150 ft	N 765,410 E 569,890	Portal Site	Investigate stratigraphy and structure at portal
UE25 - NRG - 2	210 ft	30° Bearing S75° E	0 - 210 ft	N 765,800 E 569,000	Bow Ridge Fault Area	Investigate stratigraphy and fault zone
UE25 - NRG - 3	475 ft	30° Bearing N65° W	0 - 475 ft	N 766,380 E 568,195	Valley east of Azreal Ridge	Investigate stratigraphy and presence of small faults
UE25 - NRG - 4	735 ft	0°	275 - 735 ft	N 766,830 E 566,900	Azreal Ridge	Investigate stratigraphy, especially the thickness and character of bedded tuffs between the Tiva and Topopah
UE25 - NRG - 5	1000 ft	0°	0 - 300, 650 - 1000 ft	N 767,850 E 564,700	Drill Hole Wash	Investigate bedded tuffs and contact between Tsw1 and Tsw2
UE25 - NRG - 6	1100 ft	0°	0 - 1100 ft	N 766,745 E 563,966	Drill Hole Wash	Investigate stratigraphy and fracture network for the access to the MTL. Investigate bedded tuffs and contact between Tsw1 and Tsw2

* Coordinates based on scaled map distances, with proposed drill holes located 30 feet right of centerline of ramp

Regulatory Constraints on Construction of South Ramp Portal

- **Background environmental monitoring data are needed prior to construction**
- **Existing monitoring network being upgraded to include South Portal area**

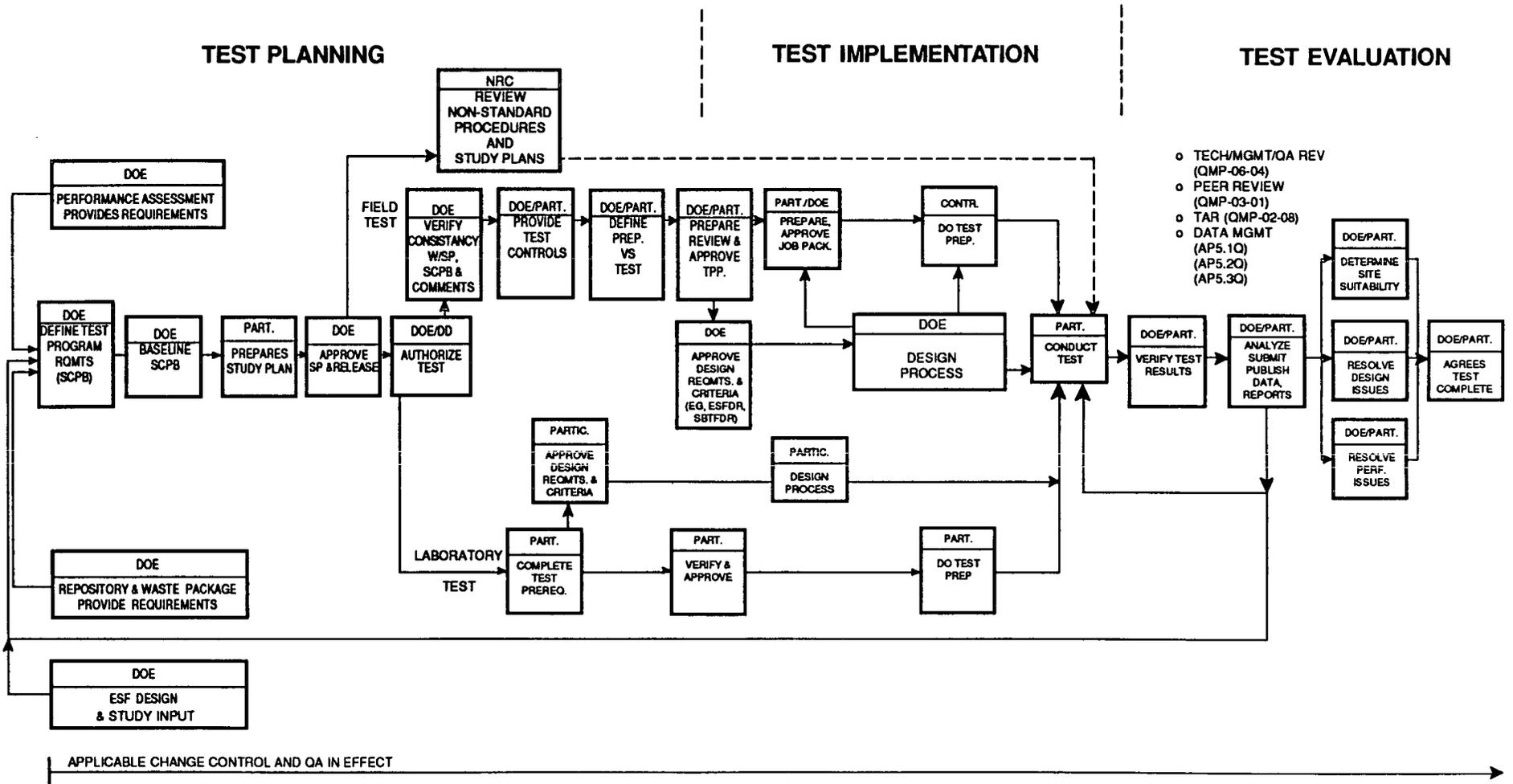
Exploration Drill Holes - South Ramp Portal Exploratory Studies Facility - Yucca Mountain Project

Number	Depth	Angle from Vertical	Core	Approximate Coordinates*	Location	Purpose
UE25 - SRG - 1	50 ft	0°	0 - 30 ft	N 756,632 E 566,390	Portal Site	Investigate stratigraphy and structure at portal
UE25 - SRG - 2	325 ft	30° Bearing N77° E	0 - 325 ft	N 756,900 E 565,055	Boundary Ridge Fault Zone	Investigate stratigraphy and fault zone
USW - SRG - 3	250 ft	30° Bearing N82° E	0 - 250 ft	N 757,100 E 563,580	Dune Wash	Investigate stratigraphy and Dune Wash Fault Zone
USW - SRG - 4	600 ft	30° Bearing S81° E	0 - 600 ft	N 757,430 E 561,165	Ghost Dance Wash	Investigate presence and character of the Ghost Dance Fault
USW - SRG - 5	1150 ft	0°	0 - 400, 750 - 1150 ft	N 758,075 E 558,315	Near Crest of Yucca Mountain	Investigate stratigraphy down through the bedded tuffs and locate Tsw1 and Tsw2

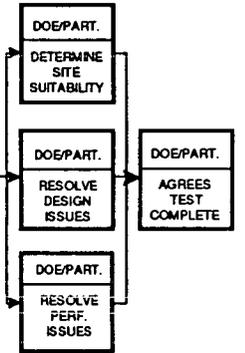
* Coordinates based on scaled map distances, with proposed drill holes located 30 feet right of centerline of ramp

Test Planning Process

SCIENTIFIC INVESTIGATION PROCESS (SITE CHARACTERIZATION)



- o TECH/MGMT/OA REV (QMP-06-04)
- o PEER REVIEW (QMP-03-01)
- o TAR (QMP-02-08)
- o DATA MGMT (AP5.1Q) (AP5.2Q) (AP5.3Q)



APPLICABLE CHANGE CONTROL AND QA IN EFFECT

Conclusion

- **A complete evaluation of the site will require both surface and underground testing**
- **Focusing on surface-based testing is one course of action at this time**
 - **Progress towards technical solutions can be demonstrated**
 - **Precursor activities to ESF are essential**
 - **Much data can be obtained to support ongoing evaluations of site suitability**