

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

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
FULL BOARD MEETING**

**SUBJECT: ACCELERATED SURFACE-BASED  
TESTING TO PROVIDE INFORMATION  
ON THE UNDISTURBED SITE AHEAD  
OF ESF CONSTRUCTION**

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**LAS VEGAS, NEVADA  
OCTOBER 19-20, 1993**

# Objectives

- **Obtain data before ESF construction**
- **Monitor effects of ESF construction on baseline conditions**
- **Assess impacts of ESF construction on site conditions**

# Data Collection Covered Primarily by Three Study Plans

## Study 8.3.1.2.2.3

- **Characterization of the percolation in the Unsaturated Zone; surface-based study**
- **Determine the *in situ* bulk-permeability and bulk-hydraulic properties of the unsaturated media**
- **Evaluate *in situ* distribution of potential energy and the pneumatic and hydraulic properties of the conducting rock**

# **Data Collection Covered Primarily by Three Study Plans**

(Continued)

## **Study 8.3.1.2.2.6**

- **Characterization of the Yucca Mountain unsaturated-zone gaseous-phase movement**
- **Determine, the near-field air conductivities, storativity, and anisotropy of units by flow, pressure, and gas-composition measurements**
- **Monitoring of gaseous circulation with time, and flow profiles with depth, should provide data that can be used to determine bulk pneumatic conductivity by model calibration**

# **Data Collection Covered Primarily by Three Study Plans**

(Continued)

## **Study 8.3.1.2.2.7**

- **Hydrochemical characterization of the unsaturated zone**
- **Understand the gas-transport mechanism and provide evidence of gas-flow direction, flux, and travel time within the unsaturated zone**
- **Evaluate the effects of air introduced to the system (natural or man-made) so that the study can provide valid results**

# Data

- **Pneumatic permeability**
- **Gas chemistry**
- ***In situ* distribution of moisture, pressure, and temperature**

# **Data Use to Assess Impacts Covered Primarily by One Study Plan**

## **Study 8.3.1.2.2.8**

- **Fluid flow in unsaturated, fractured rock**
  - **Models to help design and interpret hydrologic and pneumatic tests**
  - **Provide information about model parameters that can be incorporated into site-scale models**

# Applicable Methods/Tests

- **Gas-phase circulation**
  - Flow surveys
  - Selected gas chemistry (CH<sub>4</sub>, CO<sub>2</sub>)
  - Shut-in pressures
- **Unsaturated zone hydrochemistry**
  - Large-scale borehole gas sampling
  - Long-term periodic gas sampling
- **Unsaturated zone percolation, surface-based study**
  - Air-permeability testing
  - *In situ* long-term monitoring of moisture, pressure, and temperature



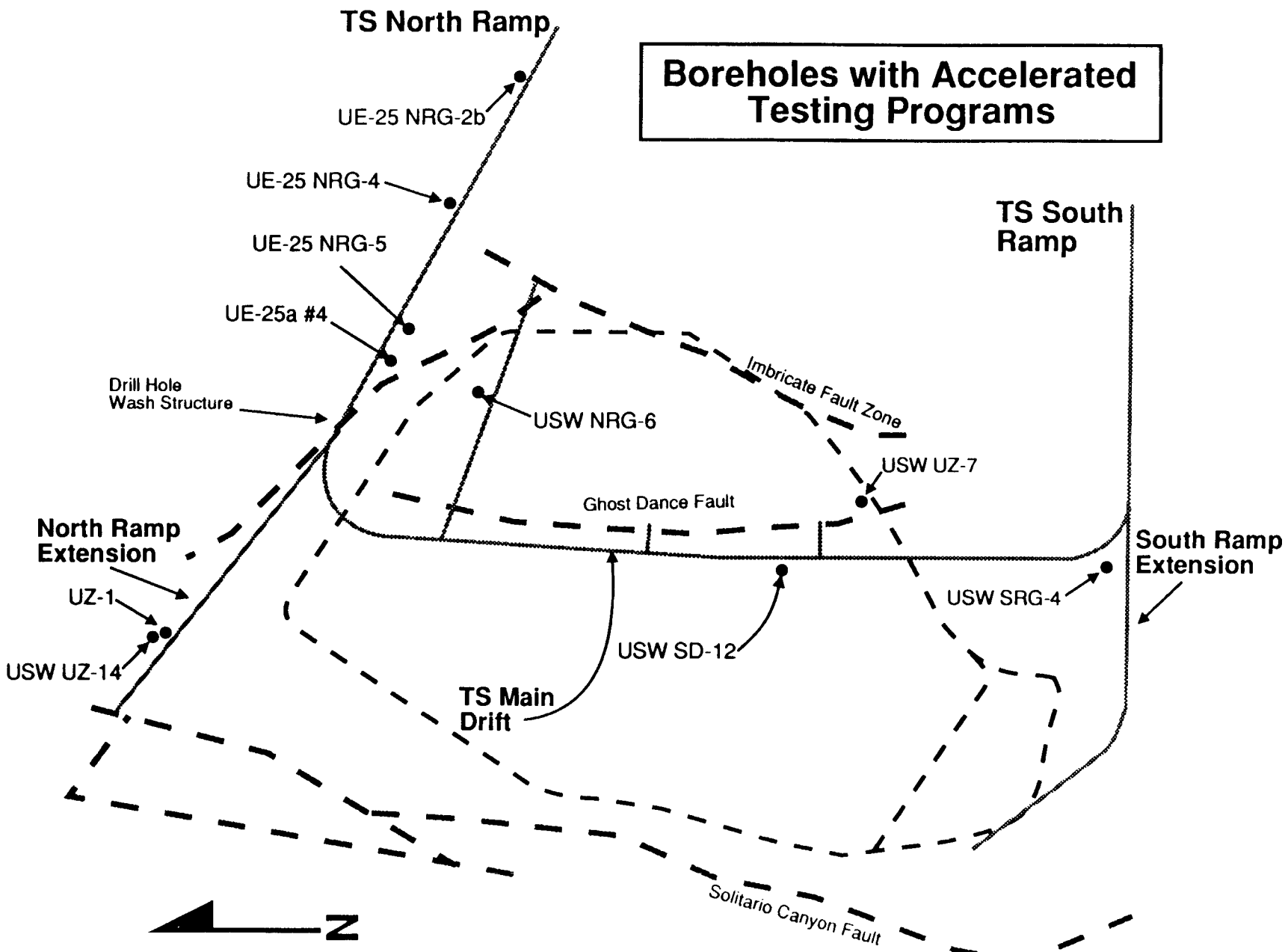
# SIMPLIFIED BOREHOLE TEST CONFIGURATIONS



# **Experience to Date in Obtaining Similar Data**

- **USW UZ-1**
  - Instrumentation
  - Gas sampling
- **G-Tunnel**
  - Development of instrumentation methods
- **Hydrologic Research Facility auger holes**
  - Demonstration of instrumentations methods
- **USW UZ-6/6s**
  - Ongoing study; topographic effects, barometric effects
- **Apache Leap**
  - Air-permeability prototype testing with packer systems

# Boreholes with Accelerated Testing Programs



# Pre-ESF Construction Data Collection

<b>UE-25a#4</b>	<ul style="list-style-type: none"><li>• Monitor gas pressures; shut-in pressures to overlap with USW NRG-6</li></ul>
<b>UE-25 NRG-2b</b>	<ul style="list-style-type: none"><li>• Flow surveys</li><li>• Selected gas chemistry collected from tubing in open hole</li><li>• Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous, as TBM approaches</li></ul>
<b>UE-25 NRG-4</b>	<ul style="list-style-type: none"><li>• Flow surveys</li><li>• Selected gas chemistry collected from tubing in open hole</li><li>• Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous, as TBM approaches</li></ul>
<b>UE-25 NRG-5</b>	<ul style="list-style-type: none"><li>• Flow surveys</li><li>• Selected gas chemistry collected from tubing in open hole</li><li>• Isolated gas chemistry and shut-in pressures; round-robin with seasons, continuous, as TBM approaches</li></ul>
<b>USW NRG-6</b>	<ul style="list-style-type: none"><li>• Flow surveys</li><li>• Selected gas chemistry collected from tubing in open hole</li><li>• Isolated gas chemistry and shut-in pressures</li><li>• Air permeability testing</li><li>• Instrument; long-term monitoring for pressure, water potential, and temperature; periodic gas sampling</li></ul>

# Pre-ESF Construction Data Collection

(Continued)

<b>USW UZ-14</b>	<ul style="list-style-type: none"><li>• Geophysical logging</li><li>• Gas-phase testing</li><li>• Gas-chemistry sampling</li><li>• Air-permeability testing</li><li>• Instrument for long-term monitoring; periodic gas sampling</li></ul>
<b>USW UZ-7</b>	<ul style="list-style-type: none"><li>• Geophysical logging</li><li>• Gas-phase testing</li><li>• Gas-chemistry sampling</li><li>• Air-permeability testing</li><li>• Instrument for long-term monitoring; periodic gas sampling</li></ul>
<b>USW SD-12</b>	<ul style="list-style-type: none"><li>• Geophysical logging</li><li>• Gas-phase testing</li><li>• Gas-chemistry sampling</li><li>• Air-permeability testing</li><li>• Instrument for long-term monitoring; periodic gas sampling</li></ul>
<b>USW SRG-4</b>	<ul style="list-style-type: none"><li>• Geophysical logging</li><li>• Gas-phase testing</li><li>• Gas-chemistry sampling</li><li>• Air-permeability testing</li><li>• Instrument for long-term monitoring; periodic gas sampling</li></ul>

# Pre-ESF Construction Data Collection

(Continued)

		STUDY			
		Gas Phase	UZ Hydro-chemistry	UZ Percolation	
Well	Status			Air-K	Instrument
USW NRG-6	Existing	X	X	X	X
UE-25a#4	Existing	X			
UE-25 NRG-2b	Existing*	X			
UE-25 NRG-4	Existing*	X			
UE-25 NRG-5	Existing*	X			
USW UZ-7	Existing*	X	X	X	X
USW UZ-14	In progress	X	X	X	X
USW SD-12	Planned	X	X	X	X
USW SRG-4	Planned	X	X	X	X

\* Requires 6 inch diameter borehole and/or casing pulled.

# Summary

**Collection of pre- and concurrent-ESF construction pneumatic, gas chemistry, and *in situ* moisture, pressure, and temperature data will be accomplished to account for ESF impacts on site characterization efforts**