U.S. NUCLEAR REGULATORY COMMISSION

ON-SITE LICENSING REPRESENTATIVE REPORT

NUMBER OR-97-04

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TABLE OF CONTENTS

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REPORT DETAILS

1.0 INTRODUCTION

The principal purpose of the On-Site Licensing Representative (OR) reports is to alert NRC staff, managers and contractors to information on the U.S. Department of Energy (DOE) programs for site characterization, repository design, performance assessment, and environmental studies that may be of use in fulfilling NRC's role during pre-licensing consultation. The principal focus of this and future OR reports will be on DOE's programs for the Exploratory Studies Facility (ESF), surface-based testing, performance assessment, data management systems and environmental studies. Relevant information includes new technical data, DOE's plans and schedules, and the status of activities to pursue site suitability and ESF development. The ORs also participate in activities associated with resolving NRC Key Technical Issues (KTI). In addition to communication of this information, any potential licensing concerns, or opinions raised in this report represent the views of the ORs and not that of NRC headquarters' staff. The reporting period for this report covers April 1-30, 1997.

2.0 OBJECTIVES

The function of the OR mission is to principally serve as a point of prompt informational exchange and consultation and to preliminarily identify concerns about site investigations relating to potential licensing issues. The ORs accomplish this function by communicating, consulting and identifying concerns. Communication is accomplished by exchanging information on data, plans, schedules, documents, activities and pending actions, and resolution of issues. The ORs consult with the DOE scientists, engineers, or managers with input from NRC Headquarters management on NRC policy, philosophy, and regulations. The ORs focus on such issues as QA, design controls, data management systems, performance assessment, and KTI resolution. A principle OR role is to identify areas in site characterization and related studies, activities, or procedures that may be of interest or concern to the NRC staff.

3.0 SUMMARY AND CONCLUSIONS

Over this reporting period, DOE completed the construction of the 5-Mile ESF Main Tunnel at Yucca Mountain. The construction of this underground facility is a major DOE achievement that facilitates a variety of ongoing and planned scientific investigations to determine the suitability of Yucca Mountain as a geologic repository.

This report highlights a number of ESF and surface-based testing activities of potential interest to NRC staff.

4.0 QUALITY ASSURANCE, ENGINEERING, AND NRC KEY TECHNICAL ISSUES

- Preparations have been made and an agenda has been developed for a May 12, 1997, periodic NRC/DOE QA videocon meeting. The meeting agenda items are primarily focused on enhancing the data and information necessary for the NRC KTI effort. The summary of this meeting will be documented in the usual QA Meeting Minutes.

- For the past two years, the NRC Office of Nuclear Reactor Regulation (NRR) has been working to develop a methodology to implement the requirements of Appendix B to Part 60 of the Title 10 of the Code of Federal Regulations (10 CFR) in a graded manner. NRR has interacted with three nuclear power plants as they develop graded QA implementation methodologies. As part of the NRC's probabalistic risk assessment plan, the NRC staff is preparing a draft Regulatory Guide that addresses graded QA. The NRR staff plans to brief the NRC Commission members, resolve any comments, and possibly issue a draft of this material in the form of a Regulatory Guide in May 1997.

  During the first week in May, the ORs met with DOE/DOE representatives regarding the graded QA program approach as discussed in Section 4.0 in the March 1997 OR Report. At this meeting, the ORs provided DOE copies of the information on the graded QA program approach NRC has released and entered into the Public Document Room. DOE planned to review this information and consider whether any of this methodology could be applied towards the high-level waste program. This can also assist the NRC KTI effort in applying the appropriate emphasis of QA and engineering data for the technical input to the KTIs.

- The ORs attended a DOE briefing to explain the methodology being directed towards improving the methodology for classifying items subject to mandatory QA requirements (Q-List). Under the original methodology, most of the items classified as a Q-Listed item were classified by direct inclusion with little or no analysis. The Q-List was also cumbersome and lengthy for a user to use and implement.

  Under the new methodology, Q-List items are intended to be classified by functional analysis rather than by direct inclusion. The Q-Listed items will be on a computer database (Lotus Notes) for unlimited visibility with

controlled access. The OR Office will be unable to access the Q-List due to not having access to the DOE Lotus Notes Data Base.

This methodology has been included as an agenda item for the May 12, 1997, NRC/DOE QA Meeting. From the OR perspective, based on this briefing, the ORs believe it is an improvement over the previous methodology.

5.0 EXPLORATORY STUDIES FACILITY AND KEY TECHNICAL ISSUES

Exploratory Studies Facility (ESF) Testing:

On April 25, 1997, at 11:40 a.m., the Tunnel Boring Machine (TBM) advanced to station 78+77 meters (25,844 feet) and reached the South Portal to complete the 5-mile excavation of the main tunnel of the ESF. Over this reporting period, geologic mapping and photogrammetry progressed approximately to station 77+90 meters. ESF construction and testing activities continues in Alcoves 5, 6, 7, and the South Ramp. However, investigators also collect barometric pressure, temperature, and relative humidity data in Alcove 4 and monitor an evaporation test outside Alcove 3. Temperature, pressure, and relative humidity data are also collected at several locations in the ESF main drift. Tensiometers and heat dissipation probes installed at two locations in the South Ramp continue to measure the dry-out of tunnel wall rock. Investigators have determined the location of two niches (stations 35+66 and 36+50) and initiated radial boreholes drilling in support of percolation flux testing. In April 1997, investigators repeated the infrared imaging in the ESF as part of the moisture monitoring program. A specially designed camera was used to take infrared images of the ESF tunnel wall every 50 meters from the North Portal to the TBM. This activity is being conducted to measure the change in tunnel wall temperature over time as a means of estimating the relative humidity and evaporation rate resulting from construction activities. This imaging will be conducted periodically to monitor temperature changes before and after the TBM is daylighted. Seismographs in Alcoves 1 and 5 continue to monitor seismicity. There was no new testing activity conducted in Alcoves 1 and 2 over this reporting period. The location of alcoves and preliminary tunnel stratigraphy is summarized in Enclosure 1.

Alcove 5 (Thermal Testing Facility Access/Observation Drift, Connecting Drift, and Heated Drift)
Constructors poured cast-in-place concrete in the lined portion of the Heated Drift over this reporting period.

Instrument holes that will be used to monitor the Heater Drift Test continue to be drilled and surveyed. This test is designed to heat approximately 15,000 cubic meters of rock in the repository horizon to 100 degrees centigrade or greater to investigate coupled thermal-hydrologic-mechanical-chemical processes. This test is scheduled to begin in December 1997.

Alcove 5 (Thermomechanical Alcove)
The Single Element Heater Test started on August 26, 1996. This test is designed to heat approximately 25 cubic meters of rock to 100 degrees centigrade or greater to investigate thermomechanical properties of rock in the potential repository horizon. All instrumentation, with the exception of some chemistry probes, are reported to be working properly and the collection of test data continues. On April 24, 1997, preliminary instrumentation measurements in the block indicated rock mass temperatures of approximately 158 and 78 degrees centigrade at distances of 0.33 and 1.5 meters, respectively, from the midpoint of the heater element. DOE may terminate the heat-up phase of this test the end of May 1997, if sufficient data has been collected.

Alcove 6 (Northern Ghost Dance Fault Alcove)
Testing in Alcove 6 is designed to investigate the hydrochemical and pneumatic properties of the Ghost Dance Fault. This alcove was previously excavated to station 1+34 meters. Investigators completed the initial phase of testing across this fault from a horizontal radial borehole. The final phase of testing will begin after the excavation of this alcove is completed. The excavation of this alcove advanced to station 1+75 meters and is expected to be completed in early May 1997.

Alcove 7 (Southern Ghost Dance Fault Alcove)
Constructors excavated this alcove to station 1+34 meters and then drilled a horizontal radial borehole from the end of this alcove to locate the Ghost Dance Fault. This borehole cut a splay and the main trace of the Ghost Dance Fault at depths of approximately 30 and 63 meters, respectively. The alcove was then excavated an additional 16 meters to prepare for the first phase of borehole testing across this fault.

Surface-Based Testing:

Fran Ridge Large Block Heater Test
The Fran Ridge Large Block Test (LBT) started on February 28, 1997, and continues its heat-up phase. The heaters are expected to be turned off in August 1997, followed by a 4-month cool-down period. Rock mass temperatures are

projected to reach approximately 140 degrees centigrade (near heaters) and 60 degrees centigrade (away from heaters). At the end of this reporting period preliminary instrument measurements in the plane of the heaters ranged from 96.0 to 103.2 degrees centigrade. The purpose of this test is to gather data to evaluate thermal-hydrologic-mechanical-chemical processes in rock similar to potential repository horizon. This test will investigate: the development of a dry-out region around the heaters and a rewetting front after cessation of boiling; the development of heat pipes and the role of fractures in the reflux of condensed water; and the effects of changes in chemistry and mineralogy and their effect on hydrology. This test will also help to discriminate among alternate conceptual models.

Borehole Testing:
The location of boreholes referenced in this section is provided in Enclosure 2.

C-Hole Complex
Tracer testing at the C-Hole Complex is conducted in the Bullfrog-Upper Tram interval of the Crater Flat Tuff for the purpose of determining hydrologic properties in the saturated zone. Conservative (non-sorbing) tracer testing continues at the C-Hole Complex. On January 9, 1997, investigators injected up to 4 kilograms of the tracer pryidone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. Breakthrough of DFBA occurred on January 16, 1997. Peak concentration values of DFBA were measured on January 21, 1997. Over this reporting period, pyridone tracer was reported in low concentrations (0.116 parts per billion) in water samples collected from borehole C#3. Water from borehole C#2 was also sampled and the pryidone tracer found in concentrations of 2 parts per billion. The preliminary interpretation is that the pryidone tracer travels from C#1 to C#2 and then on to C#3. Sampling and analyses of water pumped at C#3 continues.

New Boreholes Planned
DOE is proceeding with plans to drill two new boreholes in the Yucca Mountain area in FY97. One borehole (SD-6) will be located on the crest of Yucca Mountain and will penetrate the potential repository block. This borehole will provide information to support DOE's 3-dimensional geologic framework model, unsaturated model, design work, and to evaluate drilling cost for the performance confirmation program. A second borehole (WT-24) will investigate the large hydraulic gradient north of the potential repository block. Based on current planning, these boreholes will be dry-drilled to depths ranging from 2500 to 3000 feet, and selected stratigraphic intervals will be cored in these

boreholes. A standard suite of geophysical logs will also be run in each of these boreholes.

Pneumatic Testing

Pneumatic data recording continues at boreholes UZ-4, UZ-5, UZ-7a, SD-12, NRG-7a, SD-7 and NRG-5. In April 1997, the Seamist system was installed in UZ-14 for gas sampling and pneumatic monitoring. Nye County continues to record pneumatic data in NRG-4 and ONC-1 and collect temperature, pressure, and humidity data from instrumentation installed on the TBM.

OTHER ACTIVITIES

Construction of East-West (Enhanced Characterization) Drift at Yucca Mountain

DOE is proceeding with plans to construct an Enhanced Characterization Drift across the proposed repository block at Yucca Mountain. The purpose of the drift is to investigate the subsurface geology and hydrology west of the existing ESF tunnel. The YMP has considered a number of different configurations for this drift and is proceeding with further analysis on a preferred configuration. Although the proposed drift has a long history of being called an East-West Drift, the orientation of the preferred configuration is northeast-southwest. Excavation of the drift will begin after the necessary analysis confirms that this configuration is acceptable. The presently preferred configuration would drive the drift from the end of the North Ramp southwest across the potential repository block to intersect the Solitario Canyon Fault at about the midpoint of the block. The eastern dip of stratigraphic units at Yucca Mountain allows the drift to be excavated through the geologic section within which the potential repository would be located without penetrating the emplacement drift areas. This configuration would also preserve the option of drifting into the Calico Hills Formation after cutting through the Solitario Canyon Fault. DOE's schedule for completing this drift will be an outcome of the current planning process. The drift is being considered for eventual use as a performance confirmation drift since it will be excavated above the potential emplacement drifts.

Regional Groundwater Flow Models

DOE staff recently met with representatives from U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, U.S. Geological Service, Inyo County, Nye County, Southern Nevada Water Authority, and the Nevada State Engineers Office to discuss multi-agency support for the development of a regional groundwater flow model for the

Death Valley groundwater flow system. Two regional groundwater flow models are presently under development - one for the DOE Yucca Mountain Site Characterization Program, a second for the DOE Environmental Restoration Program of the Nevada Operations Office. These models represent extensive efforts and incorporate significant new information and both are expected to be published in FY97. DOE is considering the merits of merging these two models into one regional groundwater model to address both Yucca Mountain and Nevada Test Site groundwater concerns. If DOE merges these two models the model would be maintained in the public domain where it would be available for multi-agency and public use. A multi-year effort would be required to merge the models and develop a water resource management tool.

6.0 GENERAL

1. Appendix 7 Site Interactions

   - On April 10, 1997, and April 30, 1997, respectively, the ORs and the NRC Inspector General and staff and NRC Commissioner Kenneth Rogers visited the Yucca Mountain Site. There did not appear to be any outstanding issues raised during either of these visits.

2. Other

   - A preliminary Technical Assessment Team was formed for the purposes of: 1) identifying the appropriate disciplines needed for an effort to qualify natural resources data that was considered indeterminate as a result of a recent DOE audit and; 2) determining the appropriate methodology on how this data qualification process might be applied.

     ORs were invited to observe and provide input, from a licensing and regulatory perspective, to an internal DOE exercise for qualifying natural resources data. One set of this data was produced by a DOE supplier and as a result of deficiencies identified during a recent DOE QA audit, this set of data was considered to be indeterminate and the QA program implementation ineffective. The data for this effort may possibly be used as input to the KTI for Total System Performance Assessment and Integration.

     It was noticed that the QA deficiencies appeared to be more of a programmatic nature rather than technical. In view of this, the Technical Assessment Team decided to treat the data as indeterminate and evaluate it and make a determination as to whether it could be

qualified and used accordingly. The ORs plan to follow up on this exercise and provide more detail in subsequent OR Reports.

7.0 REPORTS

Over this reporting period the following reports were received in the NRC Las Vegas office.

LAWRENCE LIVERMORE

BIBLIOGRAPHY OF YUCCA MOUNTAIN PROJECT (YMP) PUBLICATIONS AT LAWRENCE LIVERMORE NATIONAL LABORATORY (SEPTEMBER 1977 THROUGH MARCH 1997), 3/97

LOS ALAMOS

MICROAUTORADIOGRAPHY IN STUDIES OF Pu(V) SORPTION BY TRACE AND FRACTURE MINERALS IN TUFF, D. Vaniman, A. Furlano, S. Chipera, J. Thompson, I. Triay, 1996

PALEOTRANSPORT OF LANTHANIDES AND STRONTIUM RECORDED IN CALCITE COMPOSITIONS FROM TUFFS AT YUCCA MOUNTAIN, NEVADA, USA, D. Vaniman, S. Chipera, 6/96

NUREG

NUREG/CR-6404 AN EXPERIMENTAL SCALE-MODEL STUDY OF SEISMIC RESPONSE OF AN UNDERGROUND OPENING IN JOINTED ROCK MASS, D. Kana, D. Fox, S. Hsiung, A. Chowdhury, 2/97

MISCELLANEOUS

SPRING DISCHARGE AND WATER LEVEL MONITORING AT ASH MEADOWS NWR, Water Resources Branch, Division of Engineering, Fish and Wildlife Service, Portland, OR, T. Mayer, 3/97

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+55	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+55 to 65+07	Topopah Spring crystal rich lithophysal zone
65+07 to 65+25	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+25 to 65+27	Topopah Spring crystal rich lithophysal zone
65+27 to 66+33	Topopah crystal rich nonlithophysal zone
66+33 to 66+49	Topopah Spring vitric zone
66+49 to 66+80.5	bedded tuffs
66+80.5 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+90.5	Topopah Spring crystal rich nonlithophysal zone
69+90.5 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+02	Topopah Spring crystal poor upper lithophysal zone
73+02 to 73+41	Topopah Spring crystal rich lithophysal zone
73+41? to 74+40	Topopah spring crystal rich nonlithophysal zone
74+40 to 74+50.5	Topopah Spring vitric zone
74+50.5 to 74+96	bedded tuffs
74+96 to 75+15	Tiva Canyon crystal poor vitric zone
75+15 to 76+03	Tiva Canyon crystal poor lower nonlithophysal zone
76+03 to 78+40	Tiva Canyon crystal poor middle nonlithophysal zone
76+32	Fault - offset estimated to be 0.2 meters
78+40 to 78+77	Tiva Canyon crystal poor upper lithophysal zone

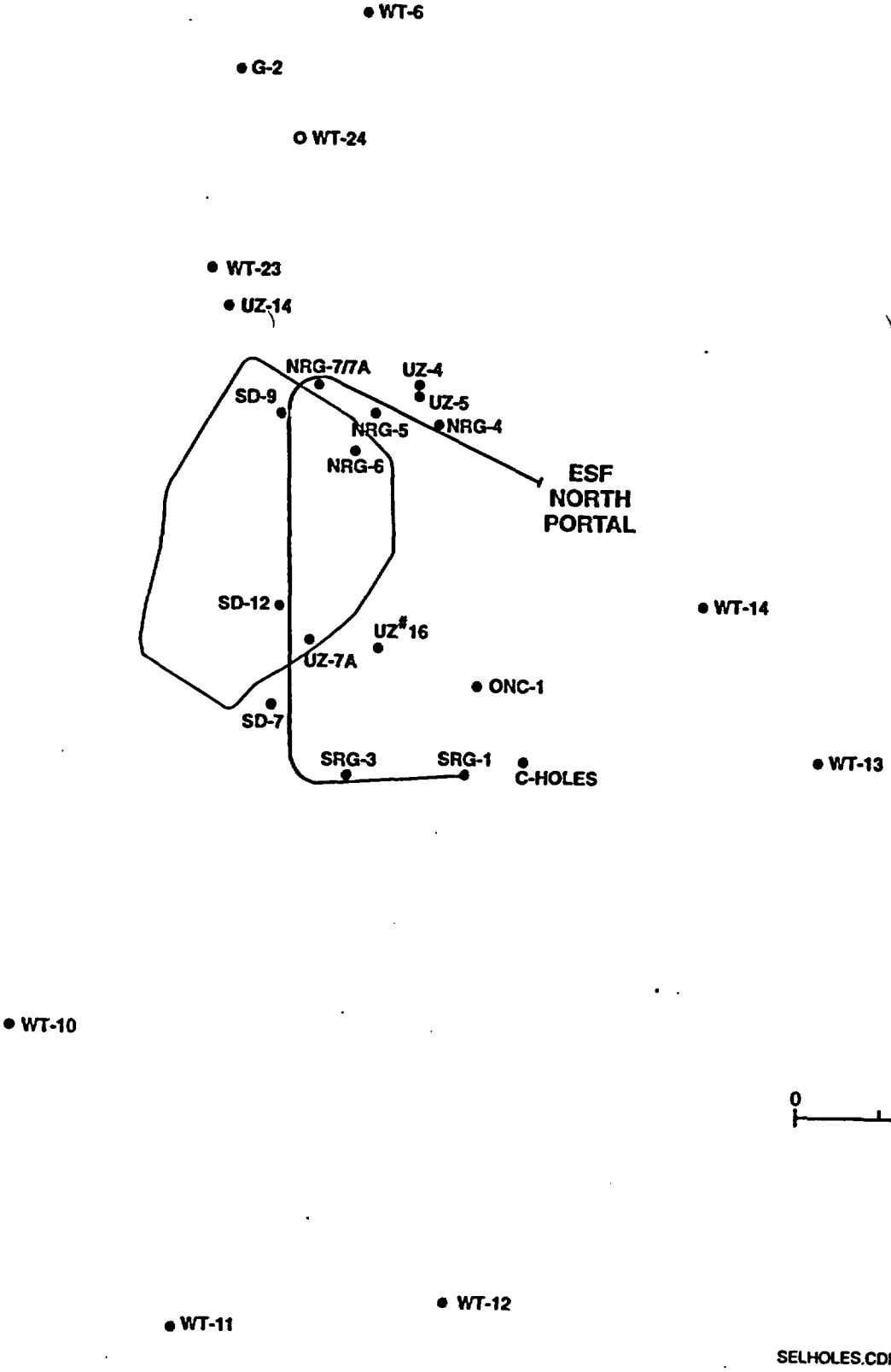
Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Selected Borehole Locations



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ENCLOSURE 2