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DISTRIBUTION OF FINAL VERSION OF 15-20 PAGE LETTER REPORT DESCRIBING ONGOING ACTIVITIES OF THE NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS (NNWSI) PROJECT

At the NNWSI Technical Project Officers (TPO) Meeting on September 24-25, 1987, it became apparent that some confusion remained regarding the distribution of the 15-20 page letter report describing ongoing investigations at Yucca Mountain. The report was required by the terms of the May 7-8, 1986, U.S. Department of Energy/Nuclear Regulatory Commission (DOE/NRC) Agreement. A final version was sent by the Waste Management Project Office (WMPO) to the Office of Geologic Repositories (OGR) on March 2, 1987, for further distribution to the NRC and states. A copy was also sent to the TPOs on March 27, 1987, but discussion at the TPO meeting indicated that it was not clear that either the TPOs or the NRC had received it. The report is particularly critical now because of the OGR decision to permit project reinitiation of ongoing activities after WMPO/OGR approval of the appropriate study plans, but prior to full NRC review.

Enclosed with this letter is the final version of the 15-20 letter report describing ongoing activities, together with the cover letters to Don Alexander at OGR and to the TPOs, which accompanied it when originally distributed.

Maxwell B. Blanchard

Maxwell B. Blanchard, Chief
Regulatory & Site Evaluation Branch
Waste Management Project Office

WMPO:DCD-100

Enclosure:
Letter Report

cc w/o encl:
H. W. Pendelton, SAIC, Las Vegas, NV
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U. S. Clanton, WMPO, NV
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87313377
WM Project: WM-11
PDR w/encl
(Return to WM, 623-SS)

WM Record File: 101
LPDR w/encl

8712010286 871002
PDR WASTE
WM-11 PDR

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MAR 27 1987

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INITIATION OF SITE CHARACTERIZATION FIELD AND LABORATORY INVESTIGATIONS

A general question keeps reoccurring - Can the Project participants conduct Site Characterization investigations once the Scientific Investigation Plans (SIPs) have been revieved and Quality Assurance Level Assignments (QALAS) have been approved?

At the present time, the answer to this general question is no. Clearly, the Office of Geologic Repositories guidance (letter from Alexander to Blanchard, dated November 17, 1986) and the U.S. Nuclear Regulatory Commission/Department of Energy (NRC/DOE) Agreement of May 7-8, 1986, specifically requires that the Site Characterization Plan and Study Plans be submitted to the NRC before the site characterization investigations can be initiated. However, there is an exception to this general statement. The exception is only for those items identified as "Ongoing Investigations" and described in the 15-20 page letter report describing ongoing and planned site characterization activities sent to the state of Nevada by DOE (see enclosure). Study Plans for these ongoing investigations must accompany the initial version of the SCP when it is delivered to the NRC.

If you have questions about this subject, please contact me at FTS 575-1091.

Maxwell B. Blanchard, Chief
Regulatory & Site Evaluation Branch
Waste Management Project Office

WMPO:MBB-1299

Enclosure:
Ltr, WMPO:MBB-1108
Blanchard to Alexander
dated 3/2/87 w/encl.

ENCLOSURE

Leitch

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MAR 02 1987

Donald H. Alexander, Chief, Technology Branch, Engineering & Geotechnology Division, Office of Civilian Radioactive Waste Management, HQ (RW-232), FORS

FINAL VERSION OF THE 15-20 PAGE LETTER REPORT DESCRIBING ONGOING AND PLANNED SITE CHARACTERIZATION ACTIVITIES IN ACCORDANCE WITH ACTION ITEM #1, PAGE 7, MAY 7-8, 1986 DOE/NRC/STATE AGREEMENT (ACTION ITEM #87-749)

We are pleased to submit the final version of the letter report describing ongoing and planned site characterization activities. This revised summary incorporates Headquarters (HQ) and Weston review comments of February 6, 1987, to the extent practicable. We found these review comments helpful in developing the final version of the text. With respect to the third HQ comment, HQ provided a list of nine activities that were identified by reviewers as potential ongoing activities. Of the nine activities, we have incorporated two into our list of ongoing activities under a geologic mapping activity which includes the collection of samples for dating purposes. Limited ongoing work related to calcite/silica deposits is already included in the geologic trenching activity (3.2.5). The remaining six activities are planned activities and should not be included in the ongoing activities list. With respect to your fourth comment, we have deleted enclosures 1 and 2, memoranda from Donald Alexander to Maxwell Blanchard, and enclosure 4, the NNWSI Project Issues Hierarchy. We propose to retain enclosure 3, SCP Chapter 8 Structure, to provide readers with a road map explaining the ties to sections of Chapter 8 of the SCP.

Finally, we have not included the HQ proposed enclosure, NNWSI Project Site Planned Accomplishments, FY 87, from the FY 88 Budget Submission. We believe that this enclosure is inappropriate for inclusion because some of the FY 87 activities that were proposed in the FY 88 budget submission will be delayed until study plans are completed. Therefore, the proposed enclosure is now in conflict with the content of the letter report.

Please contact Robert A. Levich at FTS 575-1043 or Martha W. Pendleton at FTS 575-1810, if you have any additional questions.

for: Maxwell B. Blanchard, Chief
Regulatory & Site Evaluation Branch
Waste Management Project Office

WMPO:MBB-1108

Enclosure:
As stated

cc w/encl:
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Ralph Stein, HQ (RW-23), FORS
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NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS PROJECT
SUMMARY OF ONGOING AND PLANNED SITE CHARACTERIZATION ACTIVITIES FOR THE CANDIDATE SITE AT YUCCA MOUNTAIN, NEVADA
May 1986 - April 1987

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YUCCA MOUNTAIN, NEVADA
May 1986 - April 1987

1.0 Preface

The Nuclear Waste Project Act (NWPA) of 1982 requires that the Department of Energy (DOE) prepare and issue a Site Characterization Plan (SCP) to the Nuclear Regulatory Commission (NRC) and to affected States and Indian Tribes before sinking exploratory shafts (ES) at any candidate sites. While site characterization activities related to the exploratory shaft facility (ESF) will not be initiated until after the issuance of the SCP, some surface - based activities are ongoing or may be initiated before issuance of the SCP.

During the May 7-8, 1986, NRC DOE meeting on the level of detail for site characterization plans and study plans, the DOE agreed to prepare a letter report describing these ongoing and planned site characterization activities for the States and Indian tribes. Ongoing activities are defined as site characterization activities, as defined by NWPA, that were in progress at the time of Presidential Approval (May, 1986). Planned activities are defined as site characterization activities, as defined by NWPA, that have been started, or are planned to be started, after Presidential approval, but before the expected date of SCP issuance (April, 1987).

2.0 Introduction

According to the NWPA of 1982, site characterization refers to those research activities, whether in the field or in the laboratory, that are undertaken to establish the geologic condition and the range of parameters relevant to an evaluation of the suitability of a candidate site. Yucca Mountain became a candidate site on May 28, 1986, with the President's approval of the recommendation by the Secretary of the DOE. This recommendation was accompanied by a final Environmental Assessment pursuant to the NWPA.

Site characterization activities that take place in the field include mapping, geophysical surveys, borings, surface excavations, excavation of exploratory shafts, subsurface lateral excavations and borings, and in situ testing. Laboratory activities include measurement of thermal, mechanical, and hydrological rock properties; analysis of gas and water samples and fossil plant material; detailed mineralogic and petrologic analyses; and geochemical studies under conditions simulating the repository environment. Office activities include modeling and data reduction and analysis. Excavation of an exploratory shaft and in situ testing at the depths of waste emplacement are required by the NRC (10 CFR 60.10(b)), and were described in the DOE Mission Plan.

2.1 The Nevada Nuclear Waste Storage Investigations (NNWSI) Project Site Characterization Plan (SCP).

Site information gathered during the 1978 to 1984 time frame was used to prepare the EA and to evaluate the site against the DOE siting guidelines. Site investigations completed before Presidential approval (May 1986) but not reported in the EA will be described in the SCP, tentatively scheduled for issuance in April 1987.

Data Chapters 1 through 5 of the NNWSI Project SCP will establish the current understanding about the Yucca Mountain site with regard to Geology (Chapter 1), Geoengineering (Chapter 2), Hydrology (Chapter 3), Geochemistry (Chapter 4), and Meteorology and Climate (Chapter 5). Current conceptual designs for the repository and waste package are provided in Chapters 6 and 7, respectively. Results from ongoing studies and design activities available too late for incorporation into the SCP will be reported in the semiannual Progress Reports.

Chapter 8 of the SCP contains a description of plans for site characterization activities. Section 8.1 of the SCP describes the rationale for the planned site characterization program, while Section 8.2 discusses the technical and regulatory issues that are to be resolved during site characterization. Section 8.3 is the Plans section of the SCP and is structured on the basis of Issues and Information Needs, using the NNWSI Project Issues Hierarchy. Section 8.4 describes the plans for site preparation for the surface and subsurface excavations at the exploratory shaft location and a description of the exploratory shaft and underground test facilities. Section 8.5 reviews the milestones and decision points in the site characterization program up to submittal of the license application. Section 8.6 provides a description of the Quality Assurance Program for the Project, and Section 8.7 describes the plans for decontamination and decommissioning of the candidate site if the site is not selected for development as a repository. Enclosure 1 provides a working copy of the structure of Chapter 8.

Details of planned in situ testing in the Exploratory Shaft will be described in the SCP and in Study Plans, which will provide supporting material of the Yucca Mountain SCP.

2.2 The NNWSI Project Issues Hierarchy.

The Issues Hierarchy is the means by which the NNWSI Project has abstracted and organized the repository siting and licensing requirements into a hierarchial structure of Key Issues, Issues, and Information Needs. This hierarchial structure provides a means to distinguish broad questions of overall suitability (Key Issues) from more specific questions (Issues). Some questions in the regulations governing repositories deal with performance objectives or regulatory standards; other questions deal with favorability or standard operating practices and procedures. In addition, some questions in the regulations deal with postclosure time frames, while others only deal with the preclosure period. Key Issues are related to broad technical or institutional requirements pertaining to the performance of the site with respect to compliance with applicable regulations. Issues are subordinate to Key Issues. Collectively, the group

of Issues under a Key Issue indicates what questions must be resolved to satisfy the Key Issue. The Issues are also generally readily identifiable as elements of the regulations. Information Needs are subordinate to Issues and identify the specific information, data, and analyses needed to resolve the Issues.

Issues within each Key Issue in the NNWSI Project Issues Hierarchy are grouped into Characterization, Design, and Performance Issues. The separation of topics according to preclosure and postclosure time frames is automatic, because the Key Issues explicitly make the time frame distinction. Characterization Issues encompass the site characteristics, processes, and events that may affect repository design and performance. They include detailed information on the geologic, hydrologic, and other site characteristics. Design Issues address needs for information about the design of the geologic repository operations area and its associated surface facilities and underground facility. Performance Issues address the analyses necessary to assess the suitability of the Yucca Mountain site and its proposed repository facilities as a licensable repository system. Performance Issues encompass the requirements placed on the behavior of the repository system. Key Issue 3 is not included because it represents the environmental regulatory requirements and Information Needs, and covers monitoring and mitigation efforts. Key Issue 3 will be fully developed after the Environmental Impact Statement (EIS) scoping meetings and hearings are completed.

Information Needs were used as the basis for defining the field and laboratory investigations to be conducted during site characterization. Each Information Need described in Section 8.3 of the SCP will be presented according to a standard format:

1. A list of the data and parameters to be collected to satisfy the Information Need.

2. A discussion of the logic tying the data and parameters together.

3. A description of the studies and activities planned to collect the data and parameters for the Information Need.

4. A discussion of where the data and parameters will be used as input to other Information Needs.

5. A preliminary list of planned milestones and schedules for completion of the activities and studies.

2.3 Purpose

The purpose of this report is to summarize site characterization activities at the candidate site at Yucca Mountain, Nevada, for ongoing activities and the status of planned activities. This summary is provided in response to agreements between the DOE and the NRC resulting from the May 7-8, 1986 meeting. A more comprehensive discussion will follow in the SCP.

This summary concentrates on surface-based activities, which include all field activities defined by the NWPA as site characterization activities (e.g., drilling, drillhole testing and monitoring, trenching, mapping, and surveying at the Yucca Mountain site and surrounding region) that are not directly related to the ESF. Site Characterization activities related to the ES will not be initiated until after the SCP is issued. In addition, prototype testing which is not a part of site characterization, is not included in this summary. Geochemical and thermomechanical laboratory testing related to field activities are described, as well as meteorological studies. A brief technical rationale for each activity is provided, and activities are cross-referenced to the appropriate sections in the SCP.

This report is divided into two sections: ongoing site characterization activities and planned activities.

3.0 Ongoing Site Characterization Activities: Description and Rationale

Site investigation activities were initiated in 1978 when the NNWSI Project began to focus on tuff at Yucca Mountain as a potential repository host rock. The DOE identified Yucca Mountain as a potentially acceptable site in February 1983. Publication of the final EA for the Yucca Mountain site (May 1986) establishes that the site is suitable for site characterization. It is expected that some of the previously initiated activities will continue or be completed during the time between Presidential approval of the site recommendation, and issuance of the SCP. Examples of such activities include seismic monitoring, hydrologic monitoring, meteorologic monitoring, geodetic surveys, and laboratory analyses of degradable and irreplaceable samples. Office activities include modeling and data reduction and analysis of available data. Brief descriptions of each activity are given below.

3.1 Hydrologic Activities.

Various hydrologic activities have been initiated to establish the moisture conditions of the unsaturated zone, and to determine if recharge is episodic or steady-state. Saturated zone activities have been focused on determining the position of the water table, and on establishing the characteristics of fracture hydrology. The following specific activities, including the data reduction and analyses associated with field-data collection, are ongoing.

3.1.1 Seven holes have been drilled to monitor in situ moisture conditions in the unsaturated zone (Figures 1 and 2). These holes range from 400 to about 2,000 feet deep. One of these holes, USW UZ-1, has been fully instrumented and continuously monitors hydrologic properties of the unsaturated zone. Existing holes UZ-4, 5, 6, 6s, 7, and 13 will be instrumented and monitored. Gas samples are also obtained periodically from UZ-1. UZ-8, which was only partially drilled, will be re-entered, drilled to the planned total depth and instrumented. Re-entering any of these holes may be necessary to acquire additional information using geophysical logging tools and other instrumentation. This activity supports the studies identified in section 8.3.1.2.2 of the SCP.

3.1.2 Fourteen boreholes (Figures 1 and 2) were drilled into the saturated zone for the purpose of determining the elevation of the water table at various locations at the site. These boreholes range from about 1,600 to 2,000 feet deep. Water levels in the boreholes are monitored regularly to record fluctuations in water levels as a function of time. Water table levels from the fourteen water table holes were used to establish the hydraulic gradients used to estimate the saturated zone travel times presented in the EA. This activity supports the studies identified in sections 8.3.1.2.1 and 8.3.1.2.3 of the SCP.

3.1.3 Seventy-four neutron holes (depths from 50 to 200 feet) have been drilled in the vicinity of the site to monitor the infiltration of precipitation in various geologic settings. Because of the importance of flux estimates in the unsaturated zone, monitoring data on shallow infiltration is used to determine the upper bounds on flux through the repository horizon. The holes are logged periodically with thermal and epithermal neutron tools, and gamma-gamma tools. The locations of the neutron holes are shown in figures 1 and 2. This activity supports studies identified in section 8.3.1.2.3 of the SCP.

3.1.4 Nine streamflow gages have been installed in dry washes at and near Yucca Mountain to monitor the surface-water runoff that occurs during and after storms. Streamflow gages provide data to be used in predicting the frequency and magnitude of runoff resulting from heavy precipitation events, which are typical in desert environments. This activity supports studies in sections 8.3.1.5.1, 8.3.1.6.1, and 8.3.1.16.1 of the SCP.

3.1.5 Observations of debris-flow movements are being made at the time of occurrence in order to understand the mechanisms of flow and the climatic and other factors that cause them. This effort contributes to the understanding of the conditions under which paleoflood deposits occurred. This activity supports studies identified in sections 8.3.1.5.1 and 8.3.1.6.1 of the SCP.

3.1.6 Channel scour chains have been installed at three locations in the Yucca Mountain area to measure the amount of erosion, or scour, that occurs in washes during times of heavy runoff. Heavy runoff events expose successively deeper parts of the chain, thus giving a measure of the amount of sediment movement in the wash. This activity supports studies identified in sections 8.3.1.5.1 and 8.3.1.6.1 of the SCP.

3.1.7 Water-level and pressure measurements are being recorded continuously in the three UE-25c boreholes (Figure 2), located in Drill Hole Wash, using a continuously recording data logger to evaluate barometric, tidal, and other time-related effects on water levels. This information is used to provide better understanding of fracture porosity and other aquifer properties. Long-term, continuous recording is required in order to obtain an accurate correlation of the atmospheric pressure versus water-level data. This activity supports studies identified in section 8.3.1.2.3 of the SCP.

3.1.8 A mining company is drilling boreholes in the Amargosa Desert as part of its exploration programs. This commercial company have agreed to allow installation of tubing or piezometers in their holes for NNWSI Project data collection purposes. Some tubing and piezometers have been installed to measure water levels in areas adjacent to the Yucca Mountain site in order to provide data for regional hydrologic studies. Additional instruments will be installed if additional holes are made available to the Project. This activity supports studies identified in section 8.3.1.2.1 of the SCP.

3.1.9 Measurements of temperature, precipitation, and infiltration are being made at two recharge sites at Pahute Mesa and near Tonopah that are thought to be analogous to the Yucca Mountain site under pluvial climatic conditions. Temperature of the air and soil are continuously recorded on a data logger. Precipitation samples are collected from samplers and sent to the laboratory for stable isotope analysis. The measurements will aid the estimation of ground water recharge rates at the site under future pluvial conditions. This activity supports studies identified in section 8.3.1.5.1 and 8.3.1.5.2 of the SCP.

3.1.10 Laboratory testing of crushed tuff for hydrologic and other properties is being conducted for evaluation of sealing materials. Although this effort is necessary for work on sealing concepts, it has only an indirect tie to site characterization.

3.1.11 Laboratory measurements of hydrologic properties of existing core and cuttings and water and gas samples are being made to define in situ conditions. Relationships among various hydrologic pruperties in the unsaturated zone are being identified. This activity supports studies identified in section 8.3.1.2.2 of the SCP.

3.2. Geologic Activities.

The tectonic setting of the Yucca Mountain site is important to its overall suitability as a candidate site. Seismic data and geodetic measurements are both valuable in assessing tectonic setting of the site. The following geologic activities, including the data reduction and analyses associated with field-data collection, are currently ongoing.

3.2.1 Fifty-three seismometers (Figure 3) have been installed in the region around Yucca Mountain as part of a regional seismic network, extending in lines trending east-west from the west side of Death Valley to Caliente, and generally north-south from Tonopah to Lake Mead. The two lines intersect near Yucca Mountain. The seismometers are in continuous operation and data are recorded automatically. Data from the seismic network have been used to establish the earthquake catalog for the region (Rogers et al., 1976, 1983), which is essential for predicting the size and frequency of earthquakes that are possible during the pre-

and postclosure time periods. The ability to accurately locate earthquakes is also very important for establishing the activity of faults near the site. This activity supports studies identified in sections 8.3.1.8.2 and 8.3.1.17.3.

3.2.2 Ground motions are being measured to define aspects of the design basis for the proposed site for surface facilities near Yucca Mountain. Data from surface and downhole measurements will be used to revise approaches to predicting vibratory ground motion for surface and underground facilities. Motions from underground nuclear explosions (UNEs) are analyzed to develop the relationship between earthquakes and UNEs and for prediction of potential ground motion during repository operation. This activity supports studies identified in sections 8.3.1.8.2 and 8.3.1.17.2 of the SCP.

3.2.3 Without accurate benchmarks that are routinely surveyed, it is impossible to establish local rates of vertical or horizontal tectonic movement. Therefore, geodetic survey benchmarks have been permanently installed in and around the Yucca Mountain site in order to monitor present-day tectonic adjustments in the Yucca Mountain area. A 43-mile level line extends from Crater Flat on the west to Rock Valley on the east. A quadrilateral network has been installed across several faults in the immediate vicinity of Yucca Mountain. Biannual resurveys are conducted. These activities support studies identified in sections 8.3.1.8.2 and 8.3.1.17.2 of the SCP.

3.2.4 Determination of soil characteristics for purposes of soil modeling are made on a seasonal basis. These include dust-trap sampling, determining field capacity of soils, and periodic measurements of carbon dioxide and soil gases. The soil modeling is part of the overall climate modeling effort that addresses the effects changing climate may have on the hydrologic characteristics of the site. This activity supports studies identified in section 8.3.1.5.1 of the SCP.

3.2.5 Several trenches (Figure 4) have been excavated as part of the geologic, tectonic, and paleoclimatic studies. These trenches are sampled and mapped on an ongoing basis. Occasionally, it may be necessary to deepen or lengthen existing trenches to collect additional data and to prevent degradation of the trenches. These activities support studies described in sections 8.3.1.5.1, 8.3.1.8.2, and 8.3.1.17.2 of the SCP.

3.2.6 Geologic mapping is continuing in the vicinity of Yucca Mountain as part of the geologic, tectonic and igneous activity studies. This activity includes the collection of samples to provide dates which help to define rates of tectonic and igneous processes. This activity supports studies identified in sections 8.3.1.8.1, 8.3.1.8.2, 8.3.1.17.1 and 8.3.1.17.2 of the SCP.

3.3 Meteorological Activities.

A meteorological monitoring network has been established at the Yucca Mountain site and has been collecting data since December 1985 (Figure 5). Meteorological data is collected at five towers: four are 10 meters high,

and one is 60 meters high. The four 10-meter towers continuously measure and record wind speed, wind direction, sigma theta (standard deviation of wind direction for determining atmospheric stability), relative humidity, and temperature. The fifth tower is instrumented at both the 10-meter and 60-meter levels. The data collected at this tower include the data stated above, plus sigma phi (standard deviation of vertical wind speed), net solar and terrestrial radiation, and precipitation.

These meteorological monitoring activities have begun to provide site-specific data for use in repository design studies, and eventually in the radiological safety assessments required by the NRC (10 CFR Part 60). These activities support studies identified in sections 8.3.1.2, 8.3.1.5.1 and 8.3.1.12 of the SCP.

3.4 Geomechanical Activities.

Laboratory testing, data reduction, and data analysis is ongoing for both thermal and mechanical properties. The next phase of planned testing for thermal properties is the determination of heat capacity of samples of the Topopah Spring Member of the Paintbrush Formation. These measurements are required for predicting the behavior of the host rock under the heat load generated by the waste emplaced in the repository. The next phase of planned mechanical measurements includes low-strain-rate testing, which will help determine the proper constitutive relationships for long-term conditions of the repository, and tensile strength testing, which is relevant to certain repository design analyses.

The NNWSI Project is conducting experiments in the G-Tunnel Underground Facility on Rainier Mesa. Although these experiments are not a part of site characterization, they are ongoing field activities that will guide the planning of the ESF and experiments. Therefore, a short description is provided. A principal ongoing effort in G-Tunnel is a mining evaluation experiment. Instrumented boreholes were used to determine mining-induced rock responses, and to develop improved techniques for controlled blasting in welded tuff. In situ stress and the modulus of deformation for welded tuff are also being determined at the G-Tunnel Facility. A thin slot is cut in the tuff and a flatjack is used to pressurize the side walls, moving them back to their original unrelaxed positions. Measurements obtained through these experiments provide useful experience in preparation for similar activities in the welded tuffs at Yucca Mountain.

These activities support thermomechanical studies and testing to establish repository design constraints and considerations described in section 8.3.1.15 of the SCP. These studies are important for establishing the stability of emplacement holes and drifts, particularly with regard to the requirements for retrievability.

Activities related to measurements of rock properties to be used in predictions of long-term behavior of the potential host rock under the heat load generated by the repository support studies described in section 8.3.1.14 of the SCP. These measurements are important for predicting long term rock mass response and fluid migration due to temperature effects and for establishing whether emplacement holes are likely to remain stable during the retrieval period.

3.5 Geochemical Activities.

Geochemistry of the rocks and water in contact with emplaced waste must be established in order to predict possible interactions for use in determining the lifetime of waste containers, and for predicting radionuclide transport if releases occur. The following activities, and the data reduction and analysis associated with them, are ongoing.

3.5.1 Near-Field Activities. Two types of laboratory activities are being conducted to characterize the expected time- and temperature- dependent conditions in the hydrologic environment immediately adjacent to the waste packages. These investigations are short-term hydrothermal rock-water interaction experiments between samples from the Topopah Spring Member and water from Well J-13, and experiments to determine the rates and mechanisms of dehydration and rehydration of repository near-field rock in response to the expected thermal field generated by the emplaced waste. In addition, experiments are being conducted to measure the rate at which radionuclides released during waste-form tests are picked up by rock wafers and transported through the wafers. These activities support geochemistry studies for characterizing the very near-field waste package emplacement environment identified in section 8.3.4.2 of the SCP. These studies are important for predicting the performance of the metal container, and for establishing expected release rates.

3.5.2 Far-Field Activities.

There are seven laboratory studies being conducted to better characterize geochemical conditions in the far-field. These include dynamic transport, mineralogy/petrology, sorption, natural isotope, ground-water chemistry, solubility, and hydrothermal studies. The first five studies listed involve experimental work using natural samples previously collected from the Yucca Mountain site. The following sections provide a discussion of each of these five studies.

3.5.2.1 Dynamic Transport Experiments.

The objective of the dynamic transport experiments is to determine the rate of movement of radionuclides along potential flow paths from the repository to the accessible environment. Factors under study which may potentially affect rates of movement include diffusion, dispersion, anion exclusion, sorption kinetics, and colloid movement in the flow geometries and hydrologic conditions that are expected to exist at Yucca Mountain. Ongoing transport studies include column experiments using crushed Yucca Mountain tuff, unsaturated solid tuff core, and fractured core. These column studies will provide experimentally determined hydrologic, physical, and chemical parameters needed to determine the rates of movement of various chemical species and aid in the prediction of radionuclide transport. In addition, diffusion experiments are being conducted using tuff wafers and rock beakers made from Yucca Mountain tuff. These experiments support studies described in section 8.3.1.3 of the SCP.

3.5.2.2 Mineralogy-Petrology Activities.

The objectives of the mineralogy-petrology activities are to describe the host rock mineralogy and petrology by establishing the mineralogic and petrographic stratigraphy including the mineralogic variability, and to provide descriptions of rock and fracture-fill petrology and mineralogy along potential transport pathways to the accessible environment. Ongoing activities include (1) studies of the potential for mineral alteration; (2) characterization of the fracture mineralogy using electron microscopy, x-ray diffraction, and radiometric dating on rock samples from cores, outcrops, and trenches; (3) mineral stability studies on clay, zeolites, and glasses that are important to the natural retardation system; and (4) studies of host-rock mineralogy-petrography using samples from drill cores and outcrops. These activities support studies described in section 8.3.1.3.2 of the SCP.

3.5.2.3 Sorption Activities.

The objective of the sorption activities is to provide data as input to the prediction of radionuclide movement from the repository to the accessible environment. Ongoing experiments include batch, crushed tuff column, and circulating column sorption experiments using tuff samples representative of the various mineralogic and stratigraphic characteristics of Yucca Mountain. Sorption coefficients of actinides and other important waste elements will be determined and used to estimate radionuclide retardation. Another sorption task involves studying the effects of microbes on sorption. This task involves determining the growth properties of microbes taken from soil samples collected from drilling locations at Yucca Mountain. Drilling fluids are used as the energy source for microorganism growth. Sorption coefficients of radionuclides on tuff in the presence of microbes will be determined. These activities support studies described in section 8.3.1.3.4 of the SCP.

3.5.2.4 Natural Isotope Chemistry Activities.

The objective of the activities related to natural isotope chemistry is to provide data on infiltration rates at Yucca Mountain. Chlorine-36 to total chlorine ratios are measured in Yucca Mountain soil samples, and changes in the ratio with depth are used to estimate infiltration rates. These activities support studies described in sections 8.3.1.3.1 and 8.3.1.2.2 of the SCP.

3.5.2.5 Ground Water Chemistry Activities.

The objectives of ground-water chemistry studies are to analyze the composition and the geochemical controls of the composition of pore waters in the unsaturated zone and in the saturated zone in and near Yucca Mountain. The saturated zone water chemistry has been well characterized and samples from Well J-13 are being used in the sorption and dynamic transport geochemistry tasks. Characterization

of pore waters from unsaturated zone samples is just beginning. These fluids will be extracted by applying pressure to the core sample, by centrifugation of the crushed core sample, or by vacuum distillation. These activities support studies described in section 8.3.1.3.1 of the SCP.

4.0 Planned Site Characterization Activities

The current schedule for the NNWSI Project assumes that the SCP will be completed in April 1987. At this time, the NNWSI Project does not expect to begin any new site characterization activities prior to issuance of the SCP.

Before any new site characterization activities can be started, the DOE must have appropriate agreements with the Bureau of Land Management for continued land access. DOE must also obtain the necessary environmental permits to comply with all Federal, State, and local environmental requirements during site characterization. In addition, the DOE must prepare study plans in consultation with the State and the NRC.

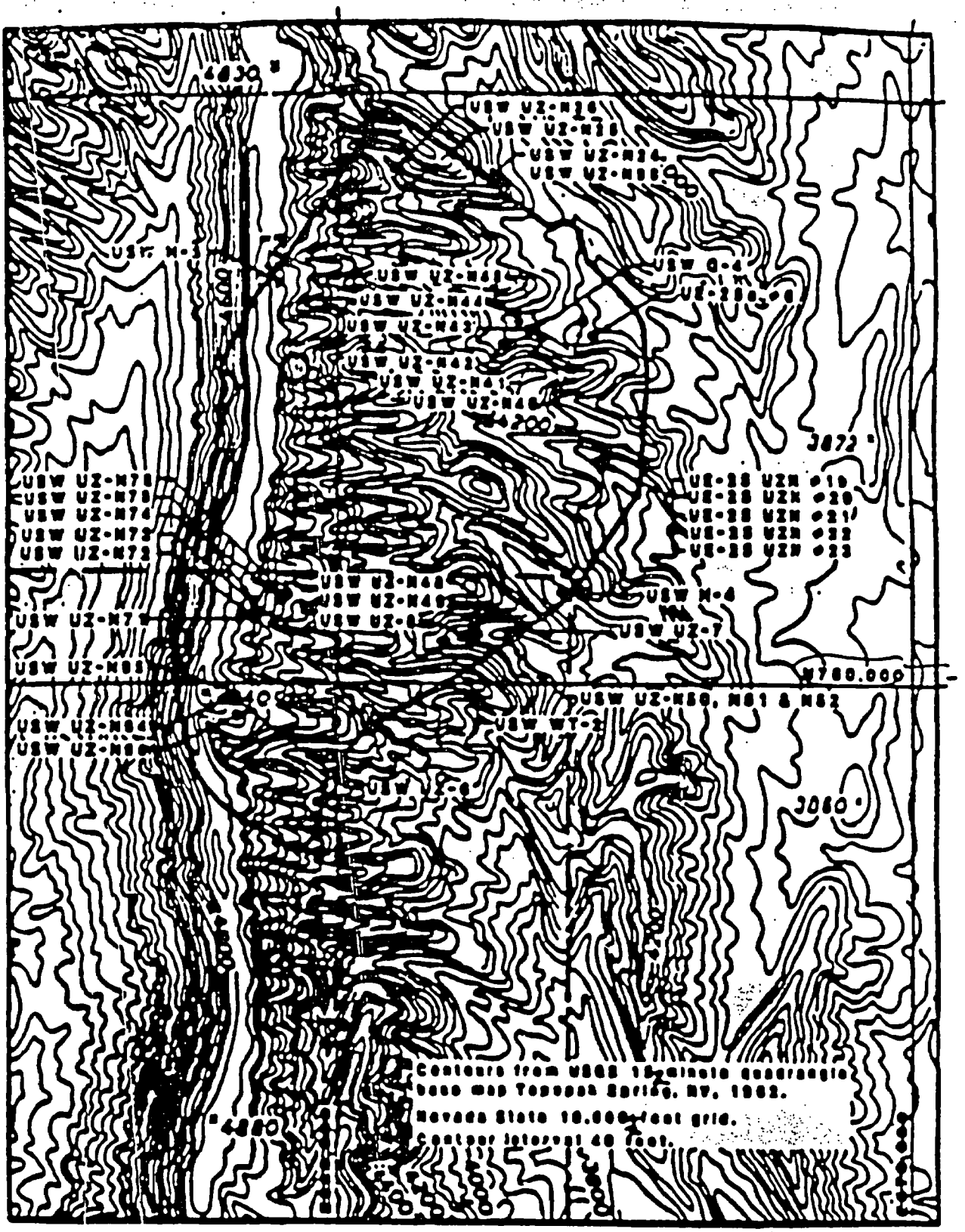

Figure 1. Drillholes located within the outline of the perimeter drift.

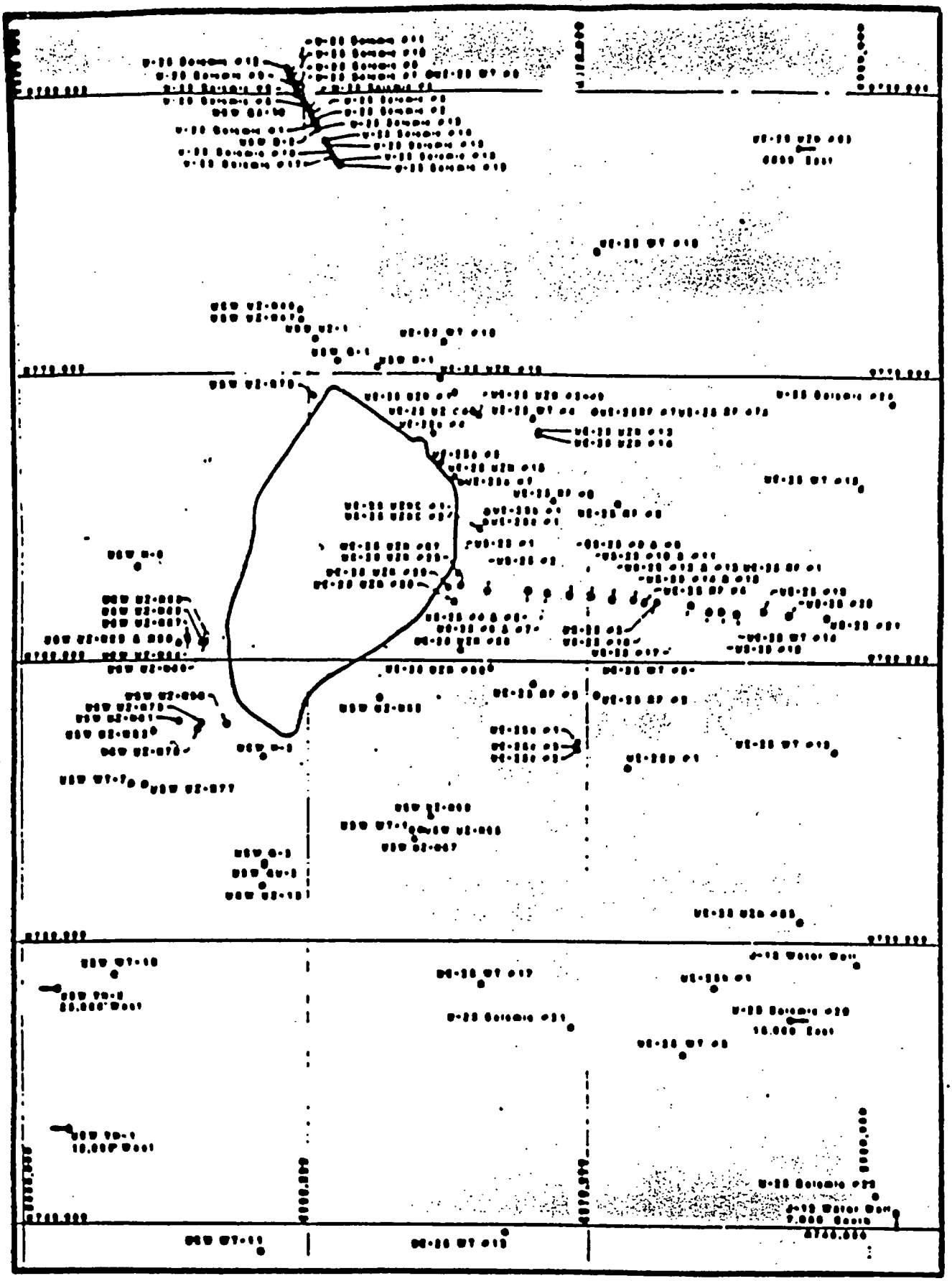

Figure 2. Drillholes located outside of the perimeter drift but within 10km of the perimeter drift.

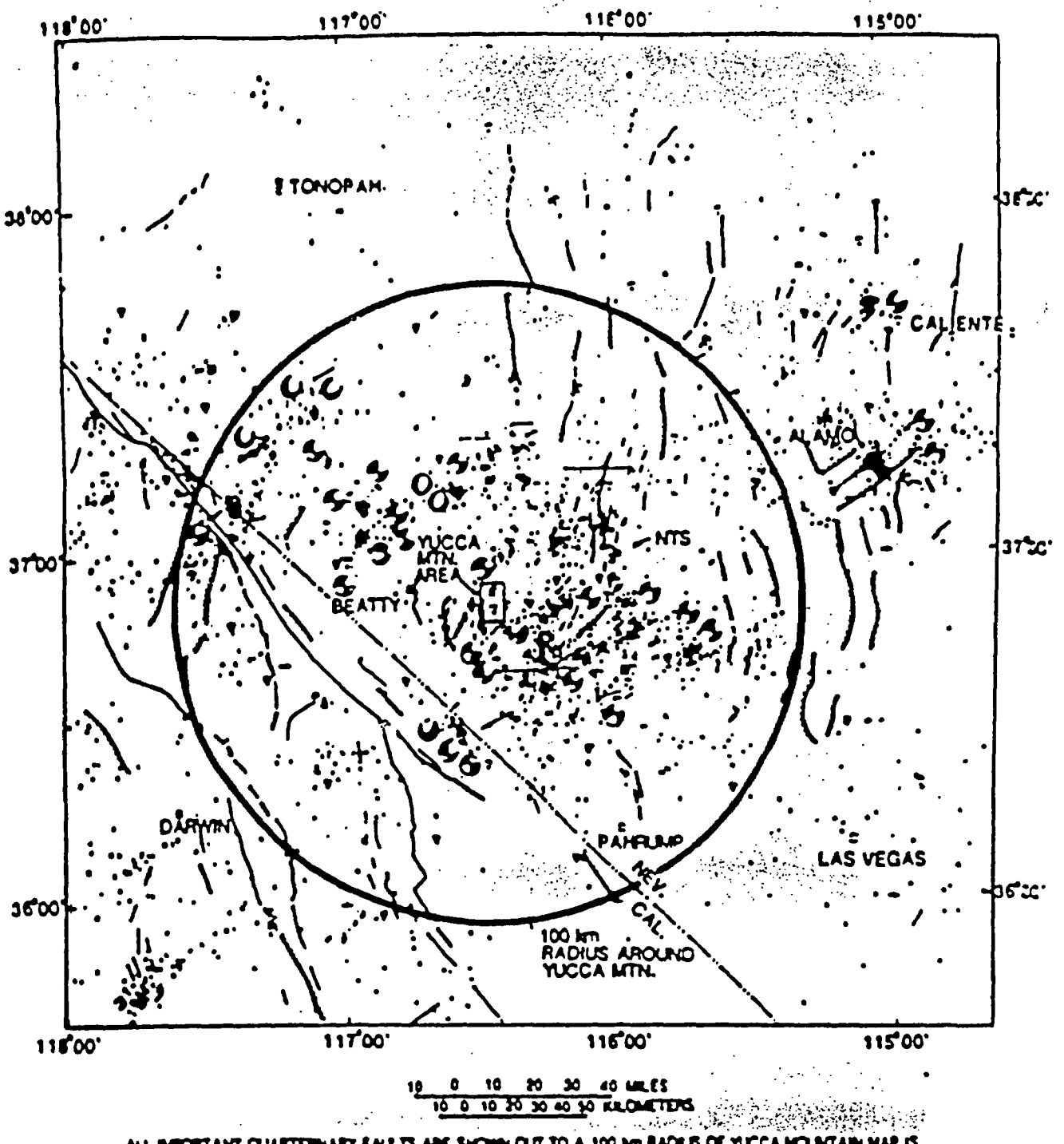

Figure 3. Regional Map showing locations of the regional seismic network.

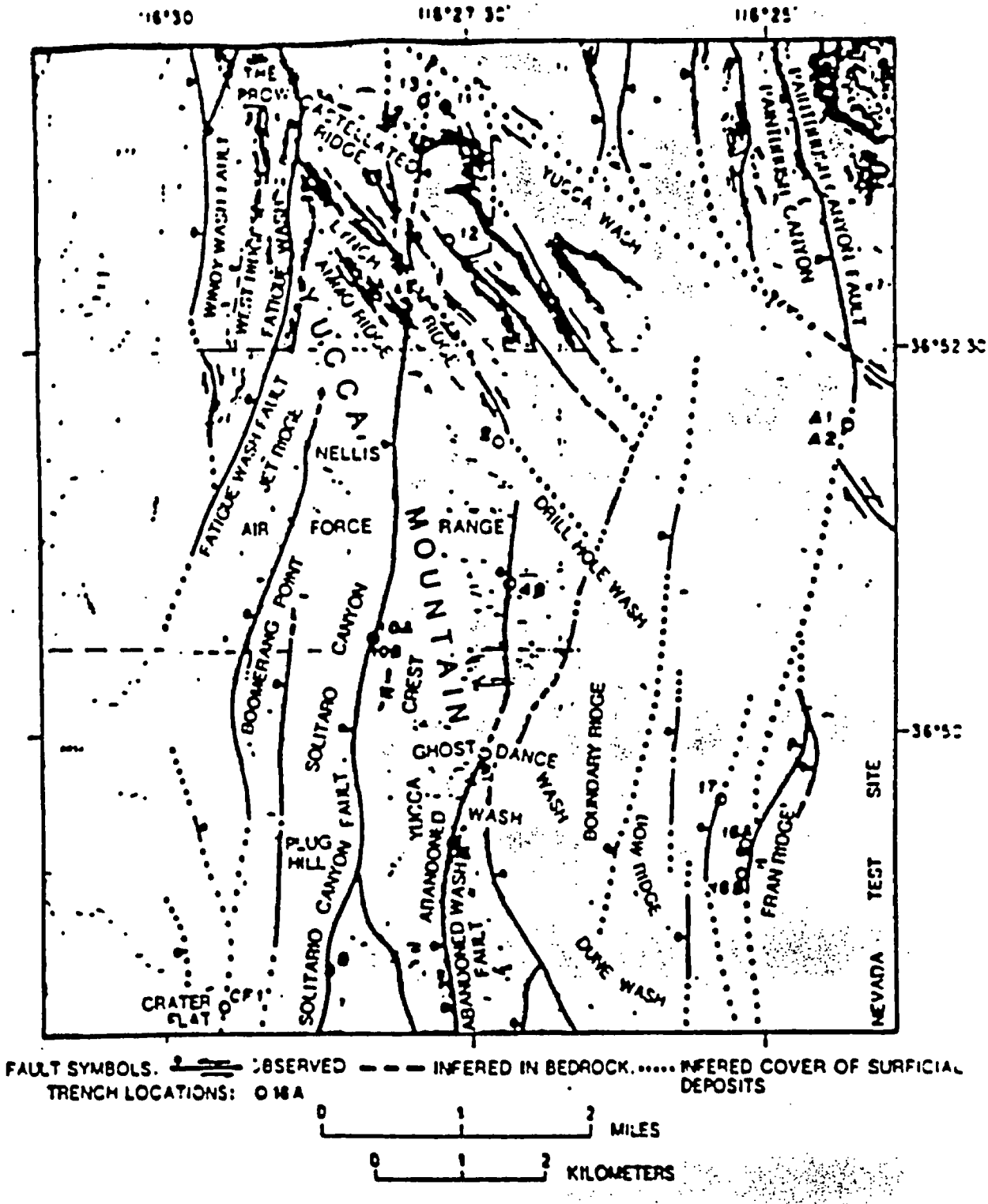

Figure 4. Trenches located along faults at Yucca Mountain interpreted from geologic mapping

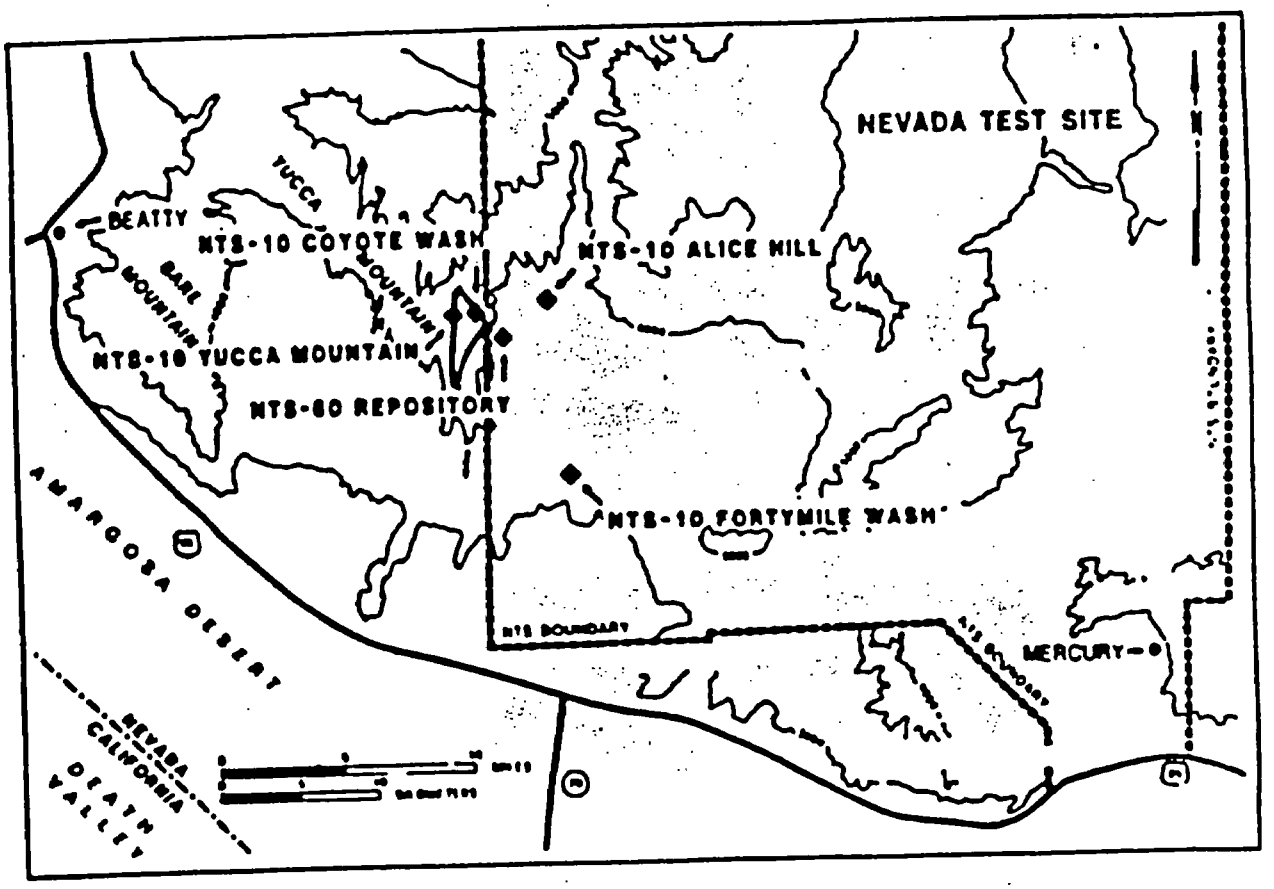

Figure 5. Meteorological monitoring sites

ENCLOSURE 1

1-16-87

REVISED SCP CHAPTER 8 STRUCTURE *

SCP Section #	Short Title	Issue or IN
8.0	INTRODUCTION	
8.1	RATIONALE	
8.1.1	Issues-Based Approach	
8.1.1.1	Derivation, structure, scope	
8.1.1.2	Application to site characterization	
8.1.2	Issue Resolution Strategy	
8.1.2.1	Issue Identification	
8.1.2.2	Performance Allocation	
8.1.2.3	Information Needs	
8.1.2.4	Investigations	
8.1.2.5	Application of Issue Strategy	
8.2	ISSUES AND INFORMATION	
8.2.1	Issues to be Resolved	
8.2.1.1	Site-Specific Issues Hierarchy	
8.2.1.2	Other Issues	
8.2.2	Approach to Issue Resolution	
8.2.2.1	Strategy for Resolution	
8.2.2.1.1	Summaries of Performance Strategies	
8.2.2.1.2	Summaries of Design Strategies	
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SCP Section #	Short Title	Issue or TV
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