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May 29, 1990

John W. Bartlett, Director
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U.S. Department of Energy
Washington, DC 20545

Dear Dr. Bartlett:

The State of Nevada has reviewed the DOE study plan "Evaluating the Location and Recency of Faulting Near Prospective Surface Facilities" (Study Plan 8.3.1.17.4.2.) and is providing its comments in this letter and attachment. The State has reviewed the Study Plan document, as well as the references cited and the supporting technical procedure on trench mapping (EP-0001). The State's comments address the adequacy, completeness, and technical accuracy of the Study Plan to meet the Department's purpose in site characterization.

The State's three primary concerns regarding the subject Study Plan are summarized as follows:

1. The Study Plan is mainly directed toward investigation of a single, previously selected repository surface facilities location in Midway Valley that contains evidence of Quaternary-age faulting, which is inconsistent with the stated purpose of the Study Plan "strictly to gather geologic data from Midway Valley and identify areas where late Quaternary faults are absent."

2. Given that the overall siting goal for repository surface facilities, as stated in the Site Characterization Plan, is to locate those facilities in an area where there is no evidence of substantial Quaternary faults, the available data do not substantiate the earlier decision to locate the facilities in Midway Valley.

3. The scientific investigation interfaces between site characterization and environmental protection required by the

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DOE Systems Engineering Management Plan have not been documented in this Study Plan.

The State finds these concerns to be of sufficient significance that we request that the Department withdraw the subject Study Plan, revisit the decision process which selected Midway Valley as the preferred location for repository surface facilities, consider all available data in a revised location selection and study plan, and insure that environmental protection considerations are effectively implemented and documented during location selection and plan development.

Our concerns result from issues summarized here, and more fully discussed in the attachment to this letter. This Study Plan is designed to characterize Quaternary faulting at and in the vicinity of the repository surface facilities proposed for Midway Valley and is thus intended to be used as the basis for evaluating the surface rupture hazard during the 100 - year life expectancy of the proposed facilities. However, the plan contains little discussion of the significance of the Midway Valley Fault described in previous studies, nor is any substantive work planned to investigate the fault in detail. Further, the plan gives little attention to the significance of the complex nature of the seismotectonic setting within which Midway Valley is situated.

The Plan places great emphasis on developing indirect negative evidence that would suggest the lack of faulting, rather than collecting direct positive evidence on the nature of faults and their activity. Reliance on the trenching program, upon which the major expectations of the study are based, is not justifiable given the inherent complexity and variability of alluvial fan stratigraphy and the known limitations of fault identification and investigation techniques in trenches.

The Study Plan appears to be directed at developing a minimum amount of new data that can be used to support a (probably) pre-1984 administrative decision (of questionable technical validity) to locate the repository surface facilities in Midway Valley, east of Exile Hill. The specific choice of the site in Midway Valley appears to have been driven more by management desire than geologic reality.

Based on limited (or no) surface and subsurface data, apparently it was concluded that the area east of Exile Hill would be the least likely to show evidence of bedrock faulting in later detailed examination. Two subsequent DOE contractor reports (Neal, 1985; and Bechtel, 1984) found that bedrock faulting was an unacceptable condition for siting the surface facilities. Therefore, a realistic and conservative interpretation of the data contained in Neal (1985) and the geophysical report by Reynolds and Associates (1985) at least should have led the Study Plan authors to the conclusion that bedrock faulting is ubiquitous throughout

Midway Valley, and caused them to reconsider Midway Valley as an acceptable location for siting repository surface facilities.

The DOE Systems Engineering Management Plan states in Section 4.4.2.7., Integration of Environment and Socioeconomic Assessment, that "Scientific investigation interfaces will be discussed in the documents that describe how the investigation will be carried out". From the State's understanding of the DOE Site Characterization program, the study plans are intended to describe how investigations are to be carried out. The subject Study Plan provides no evidence of such integration as required by the Systems Engineering Management Plan. This Study Plan contemplates a significant amount of ecological disturbance through the investigative methods proposed, therefore the plan must consider adverse impacts to the environment, discuss mitigation alternatives, and propose reclamation strategies.

We look forward to your response to this letter and attachment. Should you have questions, this Office is available to meet with the Department to discuss the State's comments at any time.

Sincerely,

Robert R. Loux
Executive Director

RRL:lmg

Attachment

cc: Carl Gertz, YMPO
Robert Browning, NRC
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ATTACHMENT

STATE OF NEVADA DETAILED COMMENTS ON DOE STUDY PLAN 8.3.1.17.4.2. "EVALUATING THE LOCATION AND RECENCY OF FAULTING NEAR PROSPECTIVE SURFACE FACILITIES".

1. CHARACTERIZATION OF QUATERNARY FAULTS IN MIDWAY VALLEY:

The Study Plan is designed to characterize the paleoseismic history of Quaternary faulting in the vicinity of the surface facilities proposed for Midway Valley and is thus intended to be used as the basis for evaluating the surface rupture hazard during the 100-year life expectancy of the proposed facilities.

The scope of the Study Plan is stated clearly; the purpose is: "... strictly to gather geologic data from Midway Valley and to identify areas where late Quaternary faults are absent." (p.i).

The type of geologic data to be collected falls within the general category of paleoseismic data. Specifications are provided by which the importance of the paleoseismic data base will judged; these specifications (p. 7) include:

* Identification of any fault within 100m of the proposed site for the waste-handling building with >1 chance in 100 of producing more than 5cm of surface offset during the preclosure period (approximately 100 yr).

* Estimate of total probability for >5cm displacement beneath the waste-handling building site considering known and possibly concealed faults and tectonic interrelationships among local faults.

* Identification and characterization of faults within 100m of the waste-handling building that have apparent Quaternary slip rates >0.001mm/yr or that measurably offset materials <100 ka.

Based on these specifications, "significant" late Quaternary faults are defined to be "... those with a slip rate >0.001 mm/yr over the last 100 ka", and the emphasis of the characterization activities in Midway Valley is on determining only the existence of these "significant" late Quaternary faults (p. 5).

The "significant" late Quaternary faults will be identified and investigated through two separate Study Plan activities (p. 36). Activity 1 involves detailed geologic mapping, soil description, age determination, geophysical exploration, and small-scale exploratory trenching. Activity 2, to be initiated following the completion of Activity 1, involves excavating long (500m) exploratory trenches across the site.

Favorable Depiction of Geologic Setting

The Study Plan outlines a detailed site-specific investigation program without adequately placing the Midway Valley site in a realistic structural-tectonic context. Although the regional geologic setting is discussed in section 1.4, "Tectonic Characteristics of the Yucca Mountain Region", the Study Plan appears to downplay the significance of the complex nature of the seismotectonic setting within which Midway Valley is situated. Although the Study Plan acknowledges that there is considerable uncertainty in the nature of Quaternary faulting at Yucca Mountain, an overly optimistic, rosy characterization of the surface facility site is repeatedly presented:

> "It is anticipated that a site in Midway Valley, with an area for waste handling buildings where no Quaternary faults are present, can be identified as a prospective location for the repository surface facilities." (p. 47-48)

> "Zones of minor (emphasis supplied) closely spaced faults are present in a few areas and postulated in others, such as Midway Valley..." (p. 13)

"Holocene fault scarps or indications of Holocene activity are not evident in Midway Valley." (p. 14)

"... trenching and radiometric age determination studies on the Bow Ridge and Paintbrush Canyon Faults bordering the study area have not conclusively demonstrated movement on these faults more recent than about 400 ka nor disproven that movement may have been as recent as the last 30-40 ka." (p. 19)

A clear understanding of the structural connection between the principal faults and the Midway Valley area should be a primary objective of the study. As is discussed at greater length in the following comment on "Narrow Scope of Work", comprehensive characterization of the Midway Valley area requires extending the study outside of the immediate surface facility area to include detailed studies on the linkage between the Paintbrush Canyon, Bow Ridge, and Midway Valley Faults.

A major deficiency of this Study Plan is that very little discussion of the significance of the Midway Valley Fault is provided, nor is any substantive work planned to investigate the fault zone in detail. A single paragraph is devoted to this fault, which directly underlies the surface facility site (p. 16-17). The significance of this fault zone is clearly

being downgraded relative to the other faults which surround the site: the Midway Valley Fault is not included on the list of "larger" Yucca Mountain faults (p. 13). With 100m of post-Tiva Canyon displacement (Neal, 1986), the Midway Valley Fault is not a minor feature. It is implied (p. 16) that the Midway Valley Fault is only an inferred structure identified in old literature (Lipman and McKay, 1965) and that more recent work by Scott and Bonk (1984) and Neal (1986) is interpretive and only postulation (p. 18). Although shown diagrammatically in the structural cross section (Fig. 1-4), the presently known structural relations of the Midway Valley Fault zone are not discussed.

The Midway Valley Fault zone is clearly similar in structural style to the neighboring Bow Ridge and Paintbrush Canyon Faults which lie 1km to the west and east, respectively. Each fault is marked by a passive structural block bounded on the west by the principal fault and a broad zone of closely spaced (imbricate) normal faulting. Unmentioned are the results of drilling and seismic reflection profiling described in Neal (1986) and Neal and Carr (1987) which suggest the presence of a series of faults directly underlying the proposed surface facility site, including an apparent high-angle reverse fault which displaces the base of the Quaternary section and has an apparent vertical throw on the order of 80-90 feet. Neal (1986) also concludes (p. 19)

that very low seismic velocities in the Tiva Canyon tuff directly under the site strongly suggest "intense fracturing".

There is a growing body of data strongly suggesting that the faults at Yucca Mountain are structurally connected, and that tectonic movements on these faults may be synchronous (Ramelli and others, 1988; 1990; Shroba and others, 1990). Since the Midway Valley Fault zone appears to have all the same structural characteristics as the other "larger" faults, it is unrealistic to compartmentalize the Midway Valley Fault. Limiting the surface facility tectonics investigation to "Identification and characterization of potentially significant Quaternary faults within 5 km of the waste-handling buildings" (p. 7) is unrealistic.

The reader of the Study Plan is left with the impression that the proposed surface facility site will most likely be contained within a tectonically stable area showing little evidence of Quaternary fault activity. A more realistic characterization of the Midway Valley structural setting and area can be made if one merely uses the published data. Rather than being an unfaulted, stable area of very old alluvium (as the Study Plan anticipates on p. 47-48), the site can be characterized as a wedge of structurally deformed Quaternary alluvium bounded by two seismotectonically active faults and underlain by an intense shatter zone. The site

would be situated directly above an earthquake nucleating at seismogenic depths on the west-dipping Paintbrush Canyon Fault (specified as the controlling preclosure event in SCP section 8.3.1.17); it is unrealistic to postulate no triggered slip on the structurally connected Midway Valley shatter zone.

Narrow Scope of Work

The principal objective of the Study Plan -- to identify areas where late Quaternary faults are absent (p. i) -- is too narrowly focused. Far too much emphasis is placed on developing indirect negative evidence that would demonstrate the lack of faulting in the upper 4m (13 ft) of alluvium immediately beneath the facility site:

> "The concern is for avoiding relative displacement at the base of the structural foundation in excess of 5cm." (p. 5);

> "Reliable estimates of the amount of fault displacements and recurrence intervals within 100m of a candidate site for the waste-handling buildings over the last 100 ka are fundamental to evaluating credible accident scenarios ..."(p. 11);

"The data in Activity 1 will provide the basis for determining the locations of long trenches in areas where Quaternary faults are likely to be absent" (p. 41).

Common practice should dictate that site investigations involve more development of direct positive evidence for degree of fault activity, including evidence developed both within and well outside of the site area. Such an approach is typically followed in even the most rudimentary seismic safety assessments, such as California's Alquist-Priolo guidelines for single-family dwellings. Trenching in the site area should be coordinated with site-specific and regional mapping to target faults that will provide data on recency and recurrence of movement.

The area designated in the Study Plan for detailed surface mapping and small-scale trenching (p. 3) covers only the southern part of Midway Valley, and does not include important structural-stratigraphic relations along the Bow Ridge and Paintbrush Canyon Faults to the north. More importantly, no detailed studies are proposed for the extreme southern part of Midway Valley, where the Paintbrush Canyon Fault bifurcates and may be structurally connected to the Midway Valley Fault. Since it is extremely difficult to characterize the Midway Valley Fault beneath the valley fill, it is essential that the paleoseismic history of this fault

be evaluated by analysis of exposed fault and stratigraphic relations elsewhere. Although it is claimed (p. 9) that other related SCP studies will provide other information necessary for characterization of Midway Valley, complete characterization of the Midway Valley Fault clearly should be contained within this Study Plan.

The two long (500m) trenches proposed for Activity 2 will be restricted to the rectangular surface facility site area, which measures only 1500 x 1800 feet (p. 4). The extent of this detailed exploratory trenching is defined solely on the basis of the perceived need to identify only late Quaternary (<100 ka) faults which are within 100m (330 feet) of the building (p. 11, 25). This 100m setback appears to be a purely arbitrary distance; it is neither conservative from a seismic hazard standpoint nor is it scientifically based. The assumption is made that the older QTa deposits are "ubiquitous within the study area" (p. 31), implying that the trenching will expose a continuous section of sediments greater than 100 ka in age through the site area. In actuality, the area contains only young surficial deposits of Q2 and Q1 age as mapped by Swadley and others (1984); analysis of aerial photographs suggests that the deposits in the immediate area of the buildings are probably Holocene in age. If the older QTa deposits are present in the subsurface, they could lie well below the 4m depth of planned trenching.

Overly Optimistic Trenching Expectations

The Objective of the long (500 m) trenching is to provide verification of:

> "... a suitable location for the waste building where late Quaternary faults are absent, or if present, can be confidently demonstrated to have slip rates of much less than 0.001mm/yr" (p. 23).

As discussed above, this approach merely produces indirect negative evidence of where faulting appears not to exist. In addition, and just as importantly, the trenching program is based upon expectations which are much too optimistic given the inherent nature of alluvial-fan stratigraphy and limitations of trenching techniques. It is also stated (p. 47) that "If possible, the trench should expose material that is at least 100 ka old and that is well stratified so that 10-cm displacements can be detected". A slip rate of 0.001mm/yr is equivalent to 10cm (4 inches) of slip in 100,000 year old deposits. Given the typically poorly stratified character of alluvial-fan deposits in the Basin and Range, it is highly unlikely that such small displacements can be detected or resolved without before-hand knowledge of the fault trace and ideal stratigraphic relations. This will be

especially true for the poorly cemented Holocene deposits which cover a large portion of the site.

Even when the exact location of the fault is know, such small displacements are extremely difficult to distinguish. The most recent trenching data from the CF-2 and CF-3 trenches across the Windy Wash Fault (Whitney and others, 1986) is an excellent example of this. The original trench logging of Swadley and others (1984) completely missed the identity of the faulted post-QTa deposits as well as the 10cm Holocene offset. A recently published paper by Bonilla and Lienkaemper (1990) also shows statistically that there is a high probability that fault traces may be nonvisible in trench exposures. They found that based on an analysis of 1200 fault traces exposed in trenches, 45% of normal faults could not be visibly traced in the trench walls to the original ground surface that existed at the time of faulting. For strike-slip and reverse faults, this nonvisibility exceeded 70%.

The goal of resolving the location and 0.001mm/yr slip rate of unknown faults through "blind" trenching is likely unattainable. A well-planned exploratory trenching program should be designed around a comprehensive regional structural-stratigraphic study which identifies and characterizes seismogenic faults. The lack of such a plan is suggested in the activity schedule (p. 54): the exploratory trenching is

planned to be initiated before the completion of the detailed geologic mapping and related fault characterization activities. The use of site-specific trenching is certainly an integral part of characterizing the paleoseismic history of the site area, but it should not serve as the principal investigative tool.

An overly optimistic view of trenching procedures and results is also presented in the supporting Sandia document on the detailed trench procedures (EP-0001). Apparently only selected portions of the trenches will be logged: "Detailed trench mapping may be performed at selected locations within a trench. If the stratigraphy is simple and no complex structures are evident, detailed trench mapping may not be required" (p. 39). Standard practice for trench logging of critical facility sites should, at a minimum, include detailed mapping of the complete trench exposure, whether there is structure present or not.

Inadequate Stratigraphic Control

Although the Study Plan proposes to develop a new chronostratigraphic framework (p. 21), heavy emphasis is still placed on using the stratigraphic scheme of Hoover and others (1981), Swadley and Hoover (1983), and Swadley and others (1984) (p. 14,15,16,21,31,40). As discussed in previous

documents, the State has reasonably demonstrated that the "surficial deposits" scheme developed by Hoover and Swadley and others is fatally flawed. As noted by Fred Peterson in his 1988 soil-geomorphic analysis of Crater Flat, their classification of deposits is inconsistent with existing soils and stratigraphic relations in Crater Flat and should be completely abandoned. The Hoover and Swadley stratigraphy has already been abandoned by Whitney and others (1986) in their detailed work on the Windy Wash Fault.

Continued use of the Hoover and Swadley stratigraphic scheme will perpetuate errors in stratigraphic control and fault interpretation. For example, the Study Plan states (p. 16) that a minimum age for movement on the Bow Ridge Fault is 38 to 270 ka. This age is taken from Swadley and others (1984) who identified unfaulted Q2a deposits in trench 14. Q2a deposits are defined as being about 40 ka old based on uranium-trend dating. In trench CF-3, however, Whitney and others (1986) dated Swadley and Hoover's Q2a deposits at between 3-6.5 ka based on TL dating. The most recent published data, therefore, suggest that the Q2a deposits in trench 14 may be as much as on order of magnitude younger than determined by Swadley and others.

2. SELECTION OF MIDWAY VALLEY FOR THE REPOSITORY SURFACE FACILITIES:

The Study Plan addresses the evaluation of faulting at the surface facility site in Midway Valley only. Given that the proposed study will focus only on the Midway Valley site #3 and that the trenching will be limited to the immediate area of the proposed waste handling buildings within Midway Valley site #3, the stated objective ("... strictly to gather geologic data from Midway Valley and to identify areas where late Quaternary faults are absent") is unlikely to be achieved. The proposed Study Plan appears to be directed at developing a limited amount of new data that can be used to support the questionable administrative decision which was probably made prior to 1984 (Neal, 1985; Neal, 1986; URS/Blume 1986; Subramanian, et. al, 1989) to use site #3 on the east side of Exile Hill. The choice to use Midway Valley on the NTS appears to have been an even earlier administrative decision made sometime between 1979-1984 without any serious consideration of alternative sites (e.g. the west side of Yucca Mountain in Crater Flat or further to the southeast in Jackass Flat) that would probably have less critical technical complexities to address. The specific choice of site #3 in Midway Valley appears also to have been driven more by management desire than geologic reality (Neal, 1985). Based on very limited new data for the six sites considered (one borehole on each of four sites; two boreholes on one site; no borehole on one site) and a liberal

interpretation of the existing geologic maps (Scott & Bonk, 1984; Swadley, et. al, 1984) it apparently was concluded that site #3 would be the least likely to show evidence of bedrock faulting, a condition that is considered unacceptable for siting the surface facilities (Neal, 1985; Bechtel, 1984). As will be discussed below, that conclusion (to choose site #3) was probably not warranted by the data. A more reasonable and conservative interpretation of the data available in 1984 (Neal, 1985) should have led to the equally valid conclusion that all of the sites on the east side of Exile Hill (2,3,4,& 5) had a high potential for finding active bedrock faulting. The only difference between the four sites (if any) appeared to be the degree of difficulty that would be encountered in identifying and characterizing all of the active bedrock faults. The high probability of finding active bedrock faulting at any of the four sites on the east side of Exile Hill and the obvious requirements to be able to characterize the connection and extent of the faulting between the sites appears to have been ignored.

Surface Facility Selection Report

Sandia Report (SAND84-2015), "Location Recommendation for Surface Facilities for the Prospective Yucca Mountain Nuclear Waste Repository" (Neal, 1985), documents "the process and evaluation numerics leading to the recommendation" for using site #3 in Midway Valley. There is evidence to suggest that

the choice of site #3 was a directed decision made sometime prior to July 1983 without the benefit of any hard data (Neal, 1985, Appendix A). This conclusion is further supported by the fact that the contracts for surface and underground facility conceptual design were started in early 1984 at the same time construction of exploratory boreholes Ue25RF-1 through 8 was initiated (Neal, 1984). SAND84-2015 (1985) also states (p. 2) that "the contractors have used and will continue to use the surface facility site (#3) recommended in this study."

The State believes that a detailed discussion of the surface facility selection report is warranted since it provides the basis for the subject Study Plan. Such discussion is also important in understanding the State's conclusion that the proposed Midway Valley Study Plan (8.3.1.17.4.2.) is inappropriate and inadequate. To that end a few additional comments on the Sandia Report (Neal, 1985) are provided since it represents the only significant source of subsurface information outside of site #3 that appears to have been available for use in developing the subject Study Plan. Also, the Sandia Location Recommendation Report presents less than a convincing argument that site #3 is the best choice among the four sites considered on the east side of Exile Hill. Depending upon how the data are interpreted, both site #4 and possibly site #5 could be a better choices

than #3. The most obvious conclusion that can be drawn from SAND84-2015, however, is that all of the sites east of Exile Hill have a high potential for containing foundation siting problems, i.e. active bedrock faulting and/or deep alluvium that obscures active bedrock faulting. It seems that a more prudent course of action would have been to abandon the Midway Valley area as a site for the surface facilities, or at the very least, develop a study plan that objectively addresses and attempts to resolve the technical issues on a broader scale before making any decisions on proceeding with the specific surface studies only at site #3.

As mentioned earlier, the stated purpose of SAND84-2015 was to "document the process and evaluation numerics leading to the recommendation" that supported the administrative decision already made to use site #3. In this respect the report was successful. It appears that some form of a modified Delphi procedure (Dalkey, 1972) was used to combine the judgement of the three (3) individuals involved. Basically, the approach consisted of establishing a number of generic criteria; assigning weights to the criteria based upon some subjective estimate of relative importance; and finally assigning some value judgement function to each of the criteria. The rest was a matter of following the procedure until the needed answer was achieved. The Delphi approach has a number of severe limitations, not the least of which include

the inability to handle implicit trade-offs between conflicting criteria (e.g. how many desert tortoise need to be sacrificed versus finding shallower alluvium); overweighing criteria that have little relevance in initially screening sites (in this case, it is the environmental parameters); and the use of "experts" to determine relative weights and assign value judgment to criteria covering areas that are not in their area of expertise (e.g. earth scientists versus bio-environmental scientists versus engineers, etc.). The Delphi approach as used by Sandia does have the advantage, however, of forcing a group consensus in the shortest period of time, a factor that is directly proportional to the number of participants. The results of this approach tell very little about whether the original decision (i.e. the choice of site #3) is good or bad, given the assumption that the right problem is even being solved.

Most of the surface information that went into SAND84-2105 was available prior to starting the study. Eight exploratory boreholes (Ue25RF-1 through 8) were constructed between January and July, 1984, ostensibly for the purpose of obtaining reconnaissance subsurface information about the six sites. It appears that no detailed evaluation of the resultant data was ever made. The limited geologic input to the SAND84-2015 report appears to be based solely on summary observations provided by Neal in a July 17, 1984 letter (Neal,

1985, Appendix B). These summary observations appear to be in part misleading and incomplete while at the same time providing some unexpected and perhaps premature interpretations as to the existence of bedrock faulting for sites #3 and #4 on the east side of Exile Hill. These data proved to have very limited effect on the outcome of the Delphi analysis, however, since both types of information were equally ignored. In essence the only borehole data that were used involved a biased estimate of the thickness of alluvium. For example, it was assumed that a shallow bedrock (less than 30') would be found on site #3 even though the alluvium thickness encountered was 90'-150'. A further example is the conclusion that the 150'+ of alluvium at site #2 would somehow cause more ground motion problems than the 115'-155' thick alluvium at site #4, and considerably more problems than the 90'-150' thick alluvium at site #3. Because the thickness of alluvium estimates made up over 20% of the composite site scores, errors in fact or judgement appear to have had a significant effect on the outcome.

Notwithstanding what the data could be indicating, a new program of data collection was initiated only at site #3 in the summer of 1985. Borehole RF-3 was deepened from 150' to 301' and three new boreholes (RF-9, 10, 11) were drilled on a rough north-south line along the west side of site #3. Additionally, in August, 1985, a seismic reflection and

refraction survey was conducted. The area covered by the seismic survey was primarily limited to site #3 with the exception of a single short E-W refraction and reflection line on the west side of Exile Hill directly opposite site #3. These data and their interpretation (Reynolds, 1985; Neal, 1986) show a not unexpected picture that is considerably more complex than was inferred previously (Neal, 1985). The data indicate that faulting in the bedrock Tiva Canyon caprock is likely to be pervasive. Neal (1986) concludes that if the Scott and Bonk, (1984) imbricate fault model is correct, the projected cumulative vertical displacement offset of the Midway Valley Fault zone structure is about 100 meters extending across a horizontal distance of over 1 kilometer (Neal, 1986, p. 5). If a horst and graben fault model, as interpreted by Reynolds (1985), is correct, (see Neal, 1986, figure 7, p. 21) the total vertical displacement over the Midway Valley Fault zone could be much greater than 100 meters. In either case the Midway Valley Fault zone appears to be a major structure that extends west, well into the area of site #3.

Given the apparent 30'-80' offset of the highly calcareous (K?) horizons between boreholes RF-9, 10, 11 and boreholes RF-3, 3a, along with the seismic reflection data interpretation by Reynolds (1985) that shows a number of the faults extending well into the Qal strata, the Midway Valley

Fault zone, by definition (10 CFR Part 60) is "active". The nature of the geology as we know it so far leads the State to the opinion that proving the Midway Valley fault zone is not "active" will be extremely difficult.

The new data collected in 1985 also indicate the optimism of the earlier (Neal, 1985) interpretation of a thin flat-lying alluvial cover over shallow bedrock on the west side of site #3. The alluvium is about 38' thick in the vicinity of RF-10 & 11 and then thickens rather abruptly to 65' in borehole RF-9. A conservative interpretation is that the thickening is due to reverse faulting offset, as suggested by Reynolds (1985). Regardless of the interpretation, the characterization of the bedrock faulting using primarily shallow 12' trenches supplemented by Ground Penetrating Radar will be difficult and is unlikely to produce definitive results. Furthermore, Ground Penetrating Radar appears to have severe limitations in desert terrains. Thus, if suitable stratigraphy were encountered in the proposed shallow trenches, the results would be highly suspect, especially if the trenches were confined only to the immediate area of site #3.

Relationship of Surface Facility Selection Report to Study Plan

There is no evidence that any of the new data collected in 1985 or any of the adverse interpretations presented in SAND85-0815 (Neal, 1986) were ever fed back into the location recommendation process, or given serious consideration in developing the proposed Study Plan (8.3.1.17.4.2) for Midway Valley site #3. The impression one gets is that the Study Plan and SAND85-0815 (Neal, 1986) were prepared concurrently by two separate groups without benefit of any cross communication. It is difficult to comprehend how implementing the proposed Study Plan will even begin to provide the type and quantities of data that most certainly will be necessary in order to reach closure on the geologic issues raised by the 1984-1985 studies.

It is the opinion of the State that the choice of site #3 within Midway Valley has not been justified. Therefore, the proposed Study Plan is premature and inappropriate. Also, there are significant technical issues that have been raised by the earlier studies (Neal, 1985, 1986) that cast doubt on the suitability of any site within Midway Valley for repository surface facilities. These technical issues can only be resolved after a more regional study of Midway Valley and the surrounding geologic framework has been completed.

3. INTEGRATION OF DOE'S ENVIRONMENTAL PROGRAM WITH STUDY PLAN:

This Study Plan brings into focus a number of questions which have been of concern to the State of Nevada regarding the integration of the DOE's environmental program with its plans for specific Yucca Mountain site studies pursuant to the Site Characterization Plan. Throughout the past few years, DOE has assured Nevada and other affected and interested parties that environmental considerations will be integrated into the Site Characterization program at the Study Plan level, when specific investigations are proposed. This Study Plan, which proposes a significant amount of ecological disturbance, provides no evidence that such considerations have, or will take place.

The disturbances include vehicle and equipment access paths, trenching, digging of soil pits, geophysical survey lines, and possible bulldozing and use of high-pressure water jets to clean bedrock pavement prior to mapping. The boundaries of the area of proposed intensive geologic work are indicated in the Study Plan, and have been established in response to earlier DOE decisions regarding the location of the prospective repository surface facility in Midway Valley. Exact locations for Activity 1 and Activity 2 disturbances are not provided in the Study Plan, although it is recognized that the proposed specific locations of some of the more severe disturbances depends upon results of some early Activity 1 work. Even with this needed flexibility, it

appears that the Study Plan contemplates sufficient disturbance to justify including an overall ecological survey and analysis of the entire proposed disturbance area, with constraining parameters identified for determining exact location of the various planned activities once specific needs are further defined. It is only through this mechanism that unnecessary environmental impacts can be adequately avoided during the planning process, as DOE has so often committed to doing.

Given that the expected evidence of environmental impact considerations in the planning process does not appear in this Study Plan, and only one sentence in the Study Plan even mentions restoration (page 27, paragraph 2), it is incumbent upon the DOE to finally provide clear and definitive responses to the following questions.

1. What specific document that is available for Nevada's review and comment prior to beginning on-site work will contain the necessary evidence of consideration of environmental impacts, alternatives, and restoration associated with disturbances planned pursuant to this Study Plan?

2. What specific standards and procedures will be applied in determining the type(s) of mitigation and restoration considered and implemented for each specific disturbance and

for the disturbed tract as a whole, and will the application of the evaluation methodology be fully documented and made available for Nevada's review and comment prior to beginning on-site work.

3. What documents that are available for Nevada's review and comment contain the detailed technical basis for deciding among alternative approaches to environmental mitigation and restoration?

4. What document that is available for Nevada's review and comment explicitly describes the functional interaction process that takes place between site characterization planners and environmental program planners when study plans are being developed pursuant to the Site Characterization Plan?

5. What document that is available for Nevada's review and comment describes DOE's compliance with the requirements of the National Environmental Policy Act with respect to proposed Site Characterization activities' environmental impacts?

6. What document that is available for Nevada's review and comment fully describes DOE's program for implementing compliance with the Endangered Species Act with respect to the

development and implementation of study plans pursuant to the Site Characterization Plan?

The responses to all of the above questions are fundamental to DOE's implementation of an acceptable environmental program with respect to Site Characterization. These same questions have been raised for a number of years by Nevada and other parties in various reviews of DOE's environmental program planning documents and specific responses have not been forthcoming. Now, with one of DOE's first study plans before us in which there is no obvious result of interaction between site characterization planners and environmental program planners, it is imperative that DOE expose for review and comment all procedural and functional elements of its comprehensive environmental program implementation, and demonstrate that it, in fact, has and is applying an acceptable, consistent and effective environmental program with respect to Site Characterization at Yucca Mountain.

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