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**STATE OF NEVADA
NUCLEAR WASTE PROJECT OFFICE**

**REVIEW AND COMMENT ON THE
U.S. DEPARTMENT OF ENERGY'S
SITE CHARACTERIZATION PLAN
FOR YUCCA MOUNTAIN, NEVADA**

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DUNN GEOSCIENCE CORPORATION
WILLIAM F. GUYTON ASSOCIATES, INC.

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ABSTRACT

This review and comment on the Site Characterization Plan (SCP) for Yucca Mountain, Nevada, as prepared by the U.S. Department of Energy (DOE), was conducted in accordance with the State of Nevada's technical oversight responsibilities as established in the Nuclear Waste Policy Act of 1982. The review itself was conducted over several months by various engineers and geoscientists experienced in such design and research endeavors.

The SCP itself was found to be very comprehensive and covered a wide spectrum of information that describes many of the proposed activities at the site during characterization. Unfortunately, many of the underlying assumptions made within the SCP that establish much of the predicted performances of the testing programs proposed may prove to be unfounded at this relatively early stage of site assessment. At this point, insufficient site-specific data exist to adequately determine the complete appropriateness and adequacy of the plans and work efforts proposed during the site characterization investigations. As such, much speculation is given to the reasonableness of the tasks proposed as a result of the lack of sufficient data. At this point in the program, both the preparers and reviewers of the SCP can only postulate expected performance.

Many of the site characterization activities will revolve around the Exploratory Shaft Facility which is the chief mechanism by which site-specific data will be obtained relating to the geologic conditions of the proposed repository horizon and the overlying formations. Of primary concern is that the proposed time frame or schedule for the testing activities is far too short to adequately assess many of the basic site characteristics. Many of the tests proposed will require an extremely long period of time to achieve accurate and reliable results. Since this required time does not exist within the program, grave concern is given to the overall success of the proposed testing activities.

From an engineering standpoint, the activities proposed during characterization were reviewed in conjunction with the proposed conceptual designs and layouts.

Many potential negative ramifications, such as those related to an increased seismic event, are discussed herein. Much evidence suggests that the Yucca Mountain site has already been determined adequate in terms of site characteristics for a deep underground geologic repository. It appears that much of the SCP was prepared to support a previously established conclusion that the Yucca Mountain site is indeed suitable for a high-level nuclear waste repository and not for the purposes of unbiasedly assessing all of the characteristics, both positive and negative, of the Yucca Mountain site as a potential host for a repository.

It is concluded that more time is needed for the complete assessment of the site characteristic behavior of the Yucca Mountain site; and, furthermore, that the testing activities should be expanded to include not only other areas on the repository block, but also a more programmatic research and testing program with sufficient time to fairly test and evaluate the overall site as a potential host for the nation's first deep geologic repository.

INTRODUCTION

This report, as prepared by H. Platt Thompson Engineering Company, Inc. (Thompson Engineering) for the State of Nevada's Nuclear Waste Project Office (NWPO), was conducted to review and comment on the Site Characterization Plan (SCP) as prepared by the U.S. Department of Energy (DOE). The reviewers of the SCP represent a varying professional background of engineering including hydrogeology, structural, mining, and civil engineering disciplines. As such, this review is primarily tailored towards the engineering considerations of the SCP. While the discussions herein cover a wide variety of subject matters, it is important that further comment and review be made on these matters to further the complete integration of all scientific disciplines into the assessment of the technical integrity of the SCP.

The review itself involved primarily the literature, data, and supporting information as provided within the SCP document; however, much referenced material was reviewed in addition to the SCP such that a better understanding of many of the discussions could be obtained. It is important to note that not every section of the SCP was reviewed in detail, as it was felt that many of the sections did not fall within the given expertise of the reviewers assigned to this project. As such, it is not the intent of the reviewers to imply that sections of the SCP are concurred with or approved as a result of no comments being made on those particular sections.

All of the reviewers were assigned various sections of the SCP for review and comment. Their comments were prepared on Technical Review Comment Forms (TRCF) for submission to the Project Manager at Thompson Engineering for compilation. To summarize the comments made by the reviewers, this report was prepared to highlight many of the comments in a concise format.

Primary concern and direction is given to aid in the ascertainment of the site characterization activities proposed within the plan to determine if the geologic setting and various parameters of the Yucca Mountain site can indeed be truly

assessed. Given the wide ranges of heterogeneity at the site, it has become very difficult to prudently assert that the true geologic condition of Yucca Mountain, Nevada, will be determined by the proposed testing activities within the SCP given time frame currently planned.

DISCUSSION

GENERAL

A tremendous amount of information within the SCP is referenced to previously published documents that are intended to support the various assumptions and conclusions made within the SCP. Without question, the whole program is in a very evolutionary state, and, as such, much of the data as presented in these previous publications appear to no longer be applicable to the discussions made within the SCP. Since much emphasis is placed on the technical integrity of these previously published documents by various research institutes, contractors, and individuals, it is important to attempt to assess the validity of the information as prepared in these documents. Within the SCP, however, much of this information is already assumed to be correct even though very little site-specific data exist from the Yucca Mountain site to accurately assert any fundamental conclusion pertaining to the characteristic geologic stability and integrity of the site.

It appears that the DOE's stance on the site characterization program is to justify the previously made conclusion that the Yucca Mountain site is adequate to host a deep geologic repository. This is rather disturbing considering that one of the primary purposes of the Site Characterization Plan is to assess the suitability of the site in an unbiased manner. The fundamental concern is that the DOE has taken an approach of a "demonstration" of suitability of the site as opposed to a "characterization" of the site for design and licensing considerations. Throughout the SCP, this philosophy pervades the discussion. Many unknowns must be answered during the site characterization phase, and many of the programs appear not to be designed so much to characterize as to demonstrate the validity of present assumptions. The eventual difficulty with this approach is that too many investigative programs are prematurely bounded by the limited assumptions that are prevalent. A true investigation and characterization would have no bounds, but would be able to respond to encountered phenomena. Many of the discussions made within the SCP reflect this commitment to the site's suitability prior to the obtainment of sufficient data that can accurately support and justify such conclusions.

The review and discussion of the SCP in this report is generally divided into two major categories with respect to waste isolation, namely 1) the natural geologic setting or barrier, and 2) the man-made or engineered barrier. From an engineering standpoint, the Yucca Mountain site is comprised of an extremely complex array of variables that must be properly assessed in order to proceed with a proper design that can benefit the waste isolation integrity of the site. Since it appears that insufficient time exists for many of the tests proposed to be conducted within the Site Characterization Plan (primarily those tests intended to assess the general nature of the physical conditions of the site), it is doubtful that every engineering parameter will be readily defined by the end of the site characterization activities. As such, the performance of any engineered facility over a reasonably long period of time cannot be accurately predicted. The result of this is the considerable emphasis that is placed on the natural geologic barriers or conditions of the Yucca Mountain site to hinder waste migration to the accessible environment. This in turn puts much emphasis on the testing programs and the research endeavors proposed to ascertain the site-specific characteristics of Yucca Mountain.

The engineering activities of the Exploratory Shaft Facility (ESF) and of a future repository is directly related to the adequacy and integrity of the data obtained as a result of the site characterization activities. Also, the post closure performance of the ESF or of a repository in turn relates to the confidence of the data obtained that is utilized in the design of all structural facilities pertaining to post closure performance, such as the seals and plugs proposed.

HYDROGEOLOGIC CONSIDERATIONS

The primary mechanism for waste migration to the accessible environment from a repository is water movement through the existing media. The Yucca Mountain site, without question, is an extremely diverse heterogeneous environment with varying degrees of lithophysae and fracture makeup. One of the large underlying assumptions of the SCP is that water movement at the Yucca Mountain site will predominantly occur through the rock matrix. While it may be agreed that matrix flow may be a significant part of the overall flux at Yucca Mountain, much more

emphasis should be given to fracture flow. In fact, it can be equally argued that fracture flow is the predominant flow mechanism at the Yucca Mountain site. Considering that one of the primary issues of the repository is to assess the potentially shortest time for waste migration away from the repository to the saturated zone below, it could be concluded that even if the flux at Yucca Mountain is predominantly through the matrix, the fastest path of migration could possibly be from fracture flow. As such, the emphasis on fracture flow should not be belittled as it has in the SCP.

It is stated that the water stored within the unsaturated zone is not expected to move spontaneously into the various openings that are mined at the site because such movement into large openings requires additional external energy to initiate a transient change such as increased infiltration from the surface or localized heterogeneities. Since periodic increased infiltration rates are expected, and the site, as a whole, is extremely heterogeneous, then it could logically be concluded that water will be expected to flow into the shafts, drifts, etc.

Due to the very complex nature of the Yucca Mountain site itself, the computational processes utilized in the hydrogeologic modeling of the site become a probability analysis at best. The differences between fracture permeabilities can be expressed in terms of magnitudes, and the faulted conditions of the Yucca Mountain site can amplify this differential severely. Considering that even in soils the variation between fine silts and coarse silts can be expressed in thousands of times, the fracture/faulting conductivities can exceed a variation of millions of times. As a result of this heterogeneity, the probability of developing and validating a model, within the time frame allotted for testing, that accurately assesses the true flux characteristics at Yucca Mountain is rather doubtful.

With respect to the hydrologic models being proposed to assess the matrix and fracture properties of the Yucca Mountain site, the rock matrix-hydrologic properties can be characterized by using geostatistical techniques. In the discussion of the geohydrologic models within the SCP, an application of these

techniques was not identified. Since these techniques offer some of the most powerful approaches to data analyses, it would be well to consider their application. If geostatistical techniques cannot be applied because of the lack of data, the information furnished from other models could prove to be erroneous and misleading, as the results will be less dependable.

The required detail of the site's hydrogeologic characteristic may not be able to be developed by boundary condition modeling. The emphasis within this type of modeling is on the control of the flow pattern by factors at a distance. The only value of such modeling would be to furnish a predictive vector of the regional flow at the site when modification of the regional flow occurs. This overall or regional vector, in this case, would not represent the local changes due to heterogeneity. It is extremely important that we keep in sight the fact that the local phenomenon or hydrologic characteristics are of prime concern and not some average flow rate or pattern projected across the site. In other words, much emphasis should be placed on local or near-field hydrogeologic characteristics. To accomplish this, the boundary conditions must be established from site-specific data and not from information or data that has been extrapolated across the site.

The statistical variations at this site are of a spatial nature. This requires an approach given by polygonal, inverse weighting, and least squares or kriging. Kriging is a geostatistical analysis of spatial variations. Since kriging is one of the most sophisticated approaches to geostatistical analysis and is readily available, it would appear prudent to consider this form of assessment within the analysis program. Within the SCP, it is difficult to see how Monte Carlo simulations could be applied to evaluate such factors at the site as geometric distribution of permeability, hydrologic head distribution, anisotropy of fractures, and the required detail of flow patterns. Furthermore, the geometric distribution of the standard deviation of such parameters would be required to properly ascertain the planning of test wells, boreholes, etc. Of course, perhaps one reason why kriging techniques were not employed within the SCP is because the standard deviation would be so enormous due to the heterogeneity of the site that the analysis itself would be proven not to produce the

desired results; thus, furthering the speculation of the successful development of an accurate hydrogeologic model of the site. If geostatistical techniques are not developed, the engineering design of any drainage facility, seal, plug, etc. may be based on unfounded data substantiated by foregone conclusions.

ESF, GEOENGINEERING, AND RELATED ACTIVITIES

Given the natural setting and arid environment of the Yucca Mountain site, there is a significant amount of uncertainty involved with many of the hydrologic considerations pertaining to the site characterization activities, the ESF, and a future repository. Due to the lack of site-specific data in this region pertaining to extreme storm events, site-specific characteristics have not been thoroughly evaluated and historical information on hydrologic patterns is virtually non-existent. To further the myriad of problems involved with the hydrologic characteristics of the site, further considerations must be given to the proposed facilities constructed during the Site Characterization Plan (i.e. the ESF) that are proposed to lie within the floodways and flood plain. Many of these issues have not been adequately addressed at this stage to state conclusively that the ESF and the related underground structural networks will not be affected by a severe hydrologic event.

The flood plain limits referenced throughout the SCP and the other pertinent hydrologic information are based primarily on information and data obtained from other regions that are proposed to have similar hydrologic characteristics. Given that the ESF will be located in Coyote Wash, the flow through the existing channels in the wash must be adequately assessed such that any future impacts to the underground facilities due to either surface flooding or infiltration can be adequately ascertained at this stage. In addition to the problems associated with flooding and infiltration, the flow velocities experienced in such channels in regions similar to Yucca Mountain have illustrated the severe potential for erosion and other geomorphic impacts. Many of the facilities proposed for the ESF are located in areas where high velocities are expected, and the potential for undermining and/or erosion should always be of concern.

At this time, an accurate representation of the site's hydrologic characteristics cannot be determined, nor is it anticipated that these characteristics can be determined in the near future. This is due to the lack of historical data and to the margin of error with the empirical equations utilized in the determination and assessment of such hydrologic regimes. Until recently, historical data was not collected on the drainage patterns in the region of the ESF and across the repository site. Even with stream-flow records of up to 100 years, long-range flood predictions are difficult to establish, as the extreme variability of flood quantities in such arid climates makes accurate predictions a very speculative process.

The SCP and the referenced material pertaining to this subject matter do not attempt to mask the difficulty in accurately assessing the hydrologic characteristics of the Yucca Mountain site. Much emphasis is placed on a previous publication by the U. S. Geological Survey (USGS) as prepared by Squires and Young (1984). This study does contain several assessments of the various ravines and channels at the site and the anticipated flow rates through them. The storm event intensities themselves have been analyzed, and models have been prepared routing these storm events across the site. At this stage, with no site-specific data pertaining to the hydrologic characteristics of the site, all of the analyses before-mentioned are extremely speculative and are based primarily on judgment. Even within the Squires and Young report, it is stated that the information and conclusions as derived from their study is only a judgment of what may occur at the site from a hydrologic standpoint.

The ESF itself, as proposed in its current location, was positioned on the repository block based on a selection procedure which analyzed five particular sites on the block itself. A screening process was utilized to narrow the field of selection down to these particular five locations that were then analyzed as possible host sites for the ESF. While the selection procedure utilized which evaluated the five sites may be found adequate or inadequate, as the case may be, of major concern is the screening process which eliminated the remainder of the repository block from any analytical site selection process.

Of the five original alternative ESF sites, the current site in Coyote Wash was selected as the most suitable to host the ESF. The relationship between the location of the ESF and the hydrologic characteristics of the Yucca Mountain site is extremely interactive. The high quantities of water that will be routed through the wash in defined channels and ravines, and the resultant ponding that will occur, will certainly affect the localized infiltration rates at and around the shafts themselves. Furthermore, much of the proposed ESF is planned to be constructed within the wash which will alter the flow patterns, resulting in possible backwater effects that must be properly assessed in order to ascertain the safety of the ESF from a severe flooding and infiltration potential. To date, no such analyses of the proposed ESF has been made evident to the preparers of this report.

The proposed underground operations and testing experiments proposed within the ESF are intended to fully characterize the existing rock mass characteristics of the site as a whole. The physical factors that control the rock mass response to excavation, and then, in turn, to the thermal loading, must have some initial bounds in order to design the limits of the proposed experiments. The SCP proposes a stress field for the target horizon based on extremely limited at-depth tests in the saturated zone further away from the repository location and in fractured rock. These tests were performed using hydrologic fracturing, which does not give realistic results in fractured rock and in rock that varies greatly in terms of heterogeneity as does tuff. Many assumptions pertaining to the stress field orientation and variations have been made within the SCP which are basically unfounded. It is stated that the stress gradient is generally uniform vertically and that the usual case for the vertical stress is to exceed the horizontal stress. Both of these assumptions may prove invalid given the limited site-specific data.

Within the SCP, strength and elastic properties of the repository horizon rock units have been assigned based upon extremely limited laboratory tests and experiments. Reanalysis of these data has shown inconsistencies in the strength value for the target horizon TSw2. The ratio of elastic modulus (modulus of elasticity or Young's modulus) to uniaxial compressive strength may generally

fall within a range of 200 to 500 (Deere, 1964). Some of these data have ratios that are not consistently in this range for the TSw series of rock. Furthermore, the calculated (or derived) properties of cohesion and angle of internal friction should correlate with the laboratory-obtained strength values. The compressive strength, cohesion, and angle of internal friction are related through the Mohr-Coulomb Relationship in the following equation:

$$\sigma_c = 2c \tan (45 + \phi/2)$$

where: σ_c = Unconfined Compressive Strength

c = Cohesion

ϕ = Angle of Internal Friction

The ratio of the modulus of elasticity to the unconfined compressive strength provides an easy check on the rock mass properties utilized from various sources. The TSw series of rock does not consistently fall within the generally accepted range of this ratio, and as a result, speculation is given towards the inconsistent strength and elastic properties that are illustrated within the SCP.

The SCP admittedly states that the lithophysal-rich portions of the TSw series of rock results in wide variations in laboratory tests and in unknown variations in field tests. The lithophysae are an "inconvenient" size for incorporation into rock mass or rock matrix property evaluations. The lithophysae are longer in dimension than a drill core is wide and are much longer than most sensor anchoring or attachment points. The relevance to this subject matter is that the SCP does not provide a detailed program for investigations or demonstrations in this class of rock type.

The availability of sufficient lateral and vertical space for waste isolation and repository development is very questionable, and the SCP devotes considerable discussion to justifying the available space. Much discussion is made to the thermal area loading and the resultant impacts on expected repository performance. A rather consistent area-wide thermal load is anticipated for the repository horizon; however, the commitment to not emplace canisters in areas

where the rock conditions are not acceptable or questionable (a commitment which hopefully remains in the future) will result in localized areas of cooler temperatures which will in turn affect the overall thermal dispersion of the system. The tests planned in the ESF with respect to the thermal behavior of the rock mass are to be performed in a relatively isolated area and for a rather limited time frame. The results of these tests may not yield information and data that are truly relevant to the overall thermal system once a repository is fully in place. An area-wide, high temperature, thermal loading, as is currently expected, will result in a rock mass behavior and response different than localized heat tests can accurately predict.

The issue of thermal loading and dispersion can be directly related to the proposed retrieval operations or retrieval program as discussed in the SCP. It appears that within the SCP retrieval is apparently considered to be a simple reversal process of emplacement, and as such, no detailed investigations during the site characterization are discussed in major detail. If the canisters themselves are planned to experience temperatures greater than the boiling point of water, certainly human involvement with the retrieval process of the canisters in a fully loaded repository is very doubtful. Furthermore, mobil equipment capable of working in such an environment without the aid of constant human interaction has not been demonstrated successfully in any mining application. In essence, the problems that force the need for retrieval may in turn make retrieval itself a very difficult, if not impossible, matter.

SEISMIC ACTIVITY RELATED TO ENGINEERING DESIGN

Much concern has been raised with respect to the maximum seismic event anticipated at Yucca Mountain being far less than what actually may occur. As a result, this discussion is made to consider the effects of a larger event on both the above and below ground structures proposed at the site.

The damage resulting from seismic activities is influenced in a number of ways by the geological site characteristics of the affected area. Where the damage is related to a gross instability of the soil and rock, the result is often represented by large permanent movements of the host environment. A somewhat

less obvious effect of soil and rock conditions on structures is the influence they exert on the intensity of ground shaking, and thereby on the structural damage which may develop even though the material underlying or surrounding a structure may remain perfectly stable during a seismic event.

During seismic activities, ground motion can occur in a random fashion in all directions. Measurements of horizontal and vertical ground accelerations, made as a function of time, have indicated that the ground acceleration contributes considerably to structural failures. When a structure is subjected to ground motions due to seismic activity, it responds in a vibratory or differential displacement fashion. For structures behaving elastically, the maximum response acceleration (defined as the maximum acceleration that a structure will experience due to a given maximum ground excitation) will depend on the structure's natural period of vibration and the magnitude of the damping present.

In engineering, a convenient way to express the combined influence of the amplitude of ground accelerations, their frequency components, and to some extent, the duration of the ground shaking on different structures is represented by means of a response spectrum. It provides the engineer with a convenient tool to evaluate the maximum anticipated lateral forces that may develop in structures subjected to a given base motion excitation.

Of particular importance to the process of generating the response spectrum are the observed maximum ordinates (defined as the maximum response values of acceleration, relative velocity, and relative displacement for a given structural system) and the fundamental period at which they occur. Thus, the frequency characteristics of the ground motions and, likewise, the form of the response spectrum may be profoundly influenced by the soil/rock conditions at the site. The frequency components of the motions at different sites and the resultant form of the response spectra change in a reasonably consistent fashion depending on the "softness" or "hardness" of the natural materials' condition.

Elements of concern for the design engineer are ground motion effects on the system, system response, prediction of system behavior, limits of acceptable

behavior, and design criteria required to ensure acceptable behavior. The objective of seismic design criteria, therefore, is to mitigate possible adverse effects of vibratory ground motion on the system of concern. In the case of the ESF and the repository's underground systems design, seismic motion may mostly result from sudden displacements along established fault patterns.

While seismic analysis and design procedures are well established for surface facilities, such is not the case for underground facilities. This may be attributed to the fact that underground facilities are regarded by many as less vulnerable to vibratory ground motion and are not generally designed for seismic loads.

An empirical approach to the design for seismic events is incorporated in most building codes. The codes used for earthquake-resistant design require that a structure of a given type be designed to withstand a static lateral force having a magnitude commensurate with the anticipated seismic motions. This is expressed as a lateral force coefficient (k) multiplied by the weight of the structure. The magnitude of the coefficient usually varies with the fundamental period of the structure, which is a function of the structure's geometrics and mass. Thus, the maximum inertia loads acting on a structure during ground motion excitation is obtained by multiplying the acceleration by the mass. This equivalent static lateral loading is normally applied with a near triangular distribution to the structure, placing the greatest load at the top. These static design loads are used in conjunction with the normal dead and live loading conditions to determine the strength of structure necessary to withstand the entire loading condition including the dynamic loads induced by the seismic event.

However, the recommended level of static-design-lateral-load is generally quite low. Dynamic analyses of structures responding elastically to ground motions recorded during severe earthquakes have shown that theoretical response inertia loads may be greater than the static-design-lateral-loads recommended by such codes. Although this difference is too large to be reconciled by safety factors in design, it is well established that structures designed to the lateral loads of codes have survived severe earthquakes. The apparent anomaly has been

attributed mainly to the ability of ductile structures to dissipate energy by postelastic deformations, helped by such factors as a reduced response due to increased damping and to ground-structure interaction. Thus, the ductility of the members is considered to be one of the most important factors in the seismic design process.

Ductility, and thus factor of safety against sudden collapse of a given structural system, is an inherent feature that is built into engineering design procedures. Since seismic design loads are accounted for in the process of arriving at an ultimate design load, the ideal design approach would be one that would introduce flexibility and energy-absorbing capacity in the system, which in return will permit the seismic displacements to take place without the prospect of generating large forces. For if a structure is designed for horizontal forces that are larger than those anticipated, it will have a greater stiffness (rigidity), resulting in a system characterized by a shorter period of vibration. The impact of a shorter period of vibration is that the structure will attract and experience more horizontal force. Thus, a structure designed for much larger forces may not necessarily be safer than a similar structure that is designed based on smaller forces. By the same token, this does not mean that a design for a smaller load is more appropriate, since this will result in a structure that is more flexible and will increase the relative displacement of the system. Therefore, provisions for ductility in the design process do not directly relate to a Design Factor of Safety, per se. The safety factor is inherent in a sense that the ductility will automatically introduce reduction in the lateral loads experienced by the structure.

As a result, in earthquake-resistant design, a primary consideration is the need to have a structure capable of deforming in a ductile manner when subjected to several cycles of lateral loading well into the inelastic range. Nonlinear dynamic analysis of code-designed structures responding to a given ground motion excitation will give an indication of the order of postelastic deformations required.

Also, as mentioned previously, determination of the effects of local ground and foundation conditions on the characteristics of earthquake ground motions is an essential part of damage prevention and analysis. It is important to make reasonable assessments of the base rock motions, especially in dealing with strong motions which are of major interest, in order to make reasonably accurate evaluations of ground motions. Analysis of the effects of ground conditions on damage due primarily to the effects of ground shaking requires an understanding of the complex interrelationships between the effects of soil/rock types, soil/rock depths, the amplitudes of ground motions, the frequency characteristics of ground motions, and the basic characteristics of structural systems in order to analyze the damage resulting from seismic events.

The general nature of the response spectrum consists of a central region of amplified response and two diminishing regions of response in which, for very-low-frequency systems, the response displacement is equal to the maximum ground displacement, and for high-frequency systems, the response acceleration is equal to the maximum ground acceleration. For very-low-frequency systems, the response for all degrees of damping approaches an asymptote corresponding to the value of the maximum ground displacement. Such a system corresponds to one having a very heavy mass and a very light spring. When the ground moves relatively rapidly, the mass does not have time to move, and, therefore, the maximum strain in the spring is precisely equal to the maximum displacement of the ground. On the other hand, for a very-high-frequency system, the spring is relatively stiff and the mass is very light. Therefore, when the ground moves, the stiff spring forces the mass to move in the same direction, and the mass must, in the process, have the same acceleration as the ground at every instant. Hence, the force in the spring is that which is required to move the mass with the same acceleration as the ground, and the maximum acceleration of the mass is precisely equal to the maximum acceleration of the ground. In general, the amplification factor for displacement is less than that for velocity, which in turn is less than that for acceleration.

In the practical field of seismic design engineering and analysis, a Design Response Spectrum is used. For any given site, estimates are made of the maximum

ground acceleration, maximum ground velocity, and maximum ground displacement, and lines representing these values are drawn on a Tripartite logarithmic chart. Representative amplification factors for 50 or 84.1 percentile (a percentile of 84.1 means that 84.1 percent of the values can be expected to fall at or below that particular amplification) are used to arrive at a design horizontal response spectrum by multiplying the motion maxima values by the amplification factors for a given damping coefficient. The amplification factors for vertical motion are usually taken as two-thirds those of horizontal.

At the Yucca Mountain site, it has been assumed that seismic motion decreases with depth. Hence, a general approach at reconciling underground seismic design to that of surface design could be arrived at by reducing the surface response spectra correspondingly, given that the depth reduction for the appropriate frequencies and the geologic conditions of the site can be accurately determined (which is speculative). The applicability and usefulness of a response spectra in the evaluation of mined underground openings, such as drifts and shafts, is questionable at this stage because the openings cannot vibrate independently, but move with the host rock. A suggested approach in applying seismic design criteria to the design of underground openings is to use the peak ground motion parameters for evaluation. It is important to note that a primary mode of failure in underground design may prove to be differential displacement. Given the heterogeneous environment at the Yucca Mountain site, this failure mode may be a controlling parameter. Peak values of acceleration, velocity, relative displacement in adjacent rocks, shear, and Rayleigh wave velocities of the surrounding rock mass can be useful in evaluating the bending strains in a stiff shaft liner, axial strain around openings, response of a shaft passing through dissimilar material, and the soil/rock dynamic loading, respectively. Thus, possible issues of concern in the design for seismic events in underground openings are ground motion damage in tunnels and shafts, potential of fault movements, and the potential of damage of shaft and borehole seals.

It can be argued that one large diameter shaft placed in a given media will move or vibrate with the adjacent ground; however, as discussed, bedded material of different composition would be expected to experience displacements that were

differential in nature. As such, nonuniform loads would be anticipated on a deep shaft through such a composite environment. Furthermore, the effects of two large shafts relatively close together would probably cause stress differentials in the shaft as the material between the two shafts would be expected to behave differently during a seismic event than the surrounding undisturbed host rock.

The effect of the magnitude of seismic events on the design of structures for seismic loading can be demonstrated by studying the response of a structure modeled as a single degree of freedom system. Assuming the system has a natural period of vibration, $T = 1$ second, and a damping coefficient that is five percent that of the critical damping, the maximum design ground acceleration, using the normalized Basic Design Spectrum (from N. M. Newmark and W. J. Hall), for a design earthquake with maximum ground acceleration equal to $0.40g$ can be computed as follows:

From the response spectra with $f = 1/T = 1.0$ cps, corresponding to the curve labeled $\epsilon = 0.50$, we obtain, after correcting for $0.40g$ maximum ground acceleration, the maximum design ground acceleration as follows:

$$S_a = 1.3(0.40g) = 0.52g$$

Following the same procedure outlined above, for a design earthquake with maximum ground acceleration equal to $0.60g$, the corresponding maximum design ground acceleration equals to:

$$S_a = 1.3(0.60g) = 0.78g$$

It is obvious from this exercise that an increase in magnitude of a seismic event, for a given system with constant dynamic response characteristics (i.e., natural period and damping), will result in a correspondingly proportional increase in the dynamic loading on the system since the loading is calculated based on a function of the mass of a structure times the maximum design ground acceleration. If the maximum ground acceleration, as determined for the Yucca Mountain site, is proven to be less than what actually occurs, the results could be very severe in terms of the structural failure of the facilities placed at the site as a result of the proportionally greater seismic loading.

SEALS AND PLUGS

The shafts, ramps, and drifts of the ESF, and subsequently the repository, are proposed to be sealed and plugged to aid in the post closure performance of the underground facilities. In addition, the ESF shafts are proposed to be lined with a concrete liner (12 inches thick) to further hinder water movement into and through the shafts. Although concrete designs and mixes have been used and incorporated in structures for many years, there is no precedence for such a design and application as is currently proposed within the ESF and the repository.

Seals that are utilized in relatively stable environments may prove to have a somewhat predictable life expectancy and performance behavior; however, the Yucca Mountain environment which would host the seals and plugs proposed is subject to not only inherently changing features, as is associated with a highly heterogeneous regime, but is also subject to various significant temperature changes with the associated stresses and stress migrations. In addition, stress concentrations associated with seismic loadings (discussed in another section) can create unknown and unplanned loading and boundary conditions on the seal structure which may induce vibrational resultant stresses that are undeterminable at this stage.

One of the most common and obvious situations where concrete seals have been constructed is in the application of common reinforced concrete dams. The foundations and supporting edges of the dams are forced directly into contact with prepared rock or earth surfaces. In all cases, very significant preparation of the face of the rock contact is necessary to secure an effective seal. From the testing activities proposed, it is doubtful that the behavior characteristics of the rock mass in relation to an established seal mix design will be soundly ascertained. Furthermore, even in a dam design, there is a continuing maintenance program required for all seals to maintain effective and safe performance. This is not an option (maintenance) that will be available during the post closure performance period of the ESF or of a repository.

Since concrete or cement grout is proposed for the sealing material that is to be employed within this project, certain inherent characteristics of the material must be addressed thoroughly. Although expansive cements has been proposed, the hydrothermal experiments performed to date have revealed that the ettringite, which is responsible for the expansive characteristic of the cement, was no longer present or was decreased tremendously in the cement material once exposed to high heat. This raises the questions regarding the subsequent behavior of a cement/concrete mixture, especially in terms of the shrinkage and expansive property of the mix design. Shrinkage and other characteristics of concrete seals must be assessed over a very long period of time - much longer than the time available for evaluation and performance assessment of seals during site characterization. Any shrinkage in the seal will create stresses and strains at the face of the rock at the point of contact and bond. Although completely inert or stationary conditions may not propagate failure modes within the seal, a seismic event affecting the area may certainly cause fractures within the seals along plains of weakness.

Serious concerns about the probability of sulfates in the groundwater filtering through the site are significant for not only the disintegration of the concrete, but the effects on any reinforcing steel. The progressive deterioration of concrete will also increase the porosity of the seal and compromise the overall behavior of the seal in general. The corrosion of reinforcing steel within any seal may cause significant expansion and can create stresses in the concrete as high as 4,000 psi. These stresses will, in all probability, cause further fracturing of the concrete with the result being the creation of additional pathways for waste migration.

The current design of the shaft liners for the ESF are proposed to be an unreinforced concrete section, 12 inches thick. It is not clear why no reinforcing is utilized in the seal; however, speculation is given towards the future ease of removal such that permanent seals and plugs can be placed within the shafts. The placement of such a seal without any reinforcing is in violation of the American Concrete Institute's codes on such concrete design and construction; and more importantly, the lack of any reinforcing steel can make

the seal itself extremely weak towards the resistance of any seismic event. A perfectly round shaft is an ideal structural component considering a uniform loading around its perimeter. The reason for this is relatively simple in that no moment is generated at a node around the shaft, and the faces of the liner can remain in compression. However, once a seismic event occurs at the Yucca Mountain site, the deformational behavior of the underground facilities and the resultant stress redistribution is extremely speculative. It is not anticipated that the entire structure will move as a concise unit, but rather that differential deformation will occur at various points along the shaft causing loadings that will generate tension in many of the faces of the shaft liner. These tension forces may not be resisted sufficiently by the concrete shaft seal, as concrete inherently has a relatively very low tension strength capacity (this is why reinforcing steel is utilized in reinforced concrete design).

Los Alamos National Laboratory has conducted several studies on ancient Roman ruins in an attempt to analyze the cementitious grouts and materials utilized in the adjoining of structural stones. This information that has been gathered is very interesting and does indeed have certain applications; yet, the below ground environment at Yucca Mountain is extremely different than that previously designed for using such cementitious materials. To properly test and evaluate the performance of any seals within the ESF and a repository requires a significant amount of time to determine the effects of heat, chemical attack, and normal degradation. Since this time is not allotted for within the Site Characterization Plan, it is doubtful that any seal can be developed and designed to withstand all of the varying parameters involved for a significant design life.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion of the herein discussion, it is of concern that the proposed activities to be conducted during site characterization will not adequately provide the necessary data to firmly establish the geologic setting and various associated ranges of parameters affecting the site. One of the primary reasons for this concern is that the time frame allotted for the experiments is insufficient to accurately collect the pertinent site-specific data which will aid in the assessment of the coupled processes anticipated within a repository.

The fundamental assumptions made throughout the SCP appear to route the direction of the characterization activities towards a justification of a previously-made conclusion pertaining to the site's suitability as a host site for a high-level nuclear waste repository. Given a testing program that is established based on an unbiased research endeavor to determine if the site is a suitable host site, many of the assumptions made (such as the assumptions pertaining to the rock matrix flow) may prove incorrect.

In summary, it is recommended that further investigations be made, before the ESF is constructed, towards the myriad of complex unresolved problems that plague the site, such as the impacts of extreme hydrologic and seismic events and the accurate determination of the hydrogeologic setting. Until many of these issues are resolved, the testing program will not yield sufficient reliable data to facilitate the engineering of a repository at the Yucca Mountain site that will have an accurate predictable behavior for the extremely long life proposed for the facility.

REFERENCES

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APPENDIX (TRCF)

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 1

CHAPTER NO.: 1

SEC. NO.: 1.1

PAGE. NO.: 32

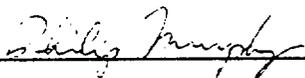
FIG./TABL:

COMMENT

The geomorphic evidence of mass wasting is declared to be an insignificant factor in the present erosional regime at Yucca Mountain. There are old slide blocks on Yucca Mountain according to the text, but the narrative does not relate these slides to the slope and the structural attitude of the rock and fracture orientations.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 2

CHAPTER NO.: 1

SEC. NO.: 1.3

PAGE. NO.: 99

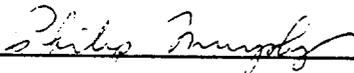
FIG./TABL:

COMMENT

Since the reasons for the possible location of volcanism is stated in pages 1-96 and 1-97, a better assessment of the rate of volcanic activity would be comparing the location of known centers of volcanism with locations based on the stated reasons.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 3

CHAPTER NO.: 1

SEC. NO.: 1.3

PAGE. NO.: 123

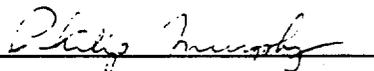
FIG./TABL:

COMMENT

The table contains columns listing age of last movement and method of dating. There is no explanation on how a definite time range was determined based only on stratigraphic correlations.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 4

CHAPTER NO.: 1

SEC. NO.: 1.3

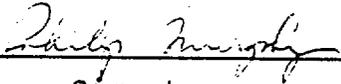
PAGE. NO.: 138 FIG./TABL:

COMMENT

Ongoing and planned studies will focus on fractures exposed on surface pavements and in underground shafts and drifts to more accurately determine the extent of subsurface fracturing that may be significant to groundwater flow. Knowledge of fracture systems are also important for designing the shafts and drifts. The frequency of fractures has been observed to decrease with depth with certain layers of the Topopah Springs member being more susceptible to fracturing including the repository horizon estimated to have 34 fractures/cubic meter. The excavation of the shafts and drifts will relieve the lithostatic pressure resulting in more fractures. This possible inherent instability of the host rock must be taken into account during the design phase.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 5

CHAPTER NO.: 1

SEC. NO.: 1.3

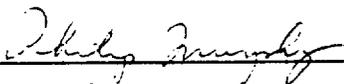
PAGE. NO.: 160 FIG./TABL:

COMMENT

If the catalog of seismic events is to be used solely for assessing seismic potential, known weapons tests and mining blasts should be deleted. However, another function of the list is to predict any stresses the repository will experience and a basic remedial design be proposed for the exploratory shaft and drifts. Weapons tests are predictable and more of a certainty than seismic events in the next 100 years. The testing will become more important if the testing areas are moved closer to the repository as shown in Figure 1-69.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 6

CHAPTER NO.: 1

SEC. NO.: 1.5

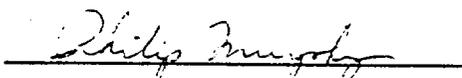
PAGE. NO.: 207 FIG./TABL:

COMMENT

The discussion comparing faulting with the unsaturated conditions of the repository concludes that the transport of radionuclides to the accessible environment is not likely in the pre-emplacment period and during the first 10,000 years. However, faulting which may occur in the post-emplacment period can change the hydrologic regime by blocking the present path of groundwater flow. The concern is not with springs appearing at the surface but with a local upwelling forming in the water table which may rise into the repository.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 7

CHAPTER NO.: 1

SEC. NO.: 1.5

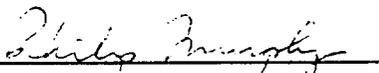
PAGE. NO.: 212 FIG./TABL:

COMMENT

The Yucca Mountain site is sufficiently distant from present or potential underground test locations and that collapse or fracture formation is highly unlikely. This is true in the larger sense but considering the stress regime and the possible tendency for the repository rock to fracture, these ground motions may be locally significant in the shaft and drifts by stress relief expressed as fractures with possible failure of walls or roof. This would especially be dangerous to the crew working in an unsupported area.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 8

CHAPTER NO.: 1

SEC. NO.: 1.8

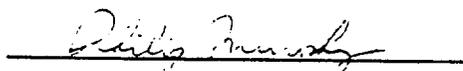
PAGE. NO.: 334 FIG./TABL:

COMMENT

Details of fracture patterns at depth may not be well established for final repository design but enough is known (pages 1-135/138-Section 1.3.2.2.2) to design for the fractures already discovered during this program.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 9

CHAPTER NO.: 1

SEC. NO.: 1.8

PAGE. NO.: 349 FIG./TABL:

COMMENT

An additional aspect of the investigation of fracturing should be observation of the core. If the core develops "discing," this would be an indication of how the rock would react to the open shafts and drifts.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 10

CHAPTER NO.: 2

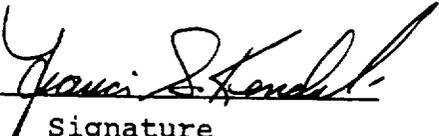
SEC. NO.: 2.0

PAGE. NO.: 2-14 FIG./TABL:

COMMENT

Rock testing samples obtained from tuff blocks obtained from outcrops have been weathered, thereby altering their properties. The use of outcrop samples for testing and extrapolation to in-situ conditions at depth needs justification.

REVIEWER: Frank Kendorski


Signature

ORGANIZATION: Dunn

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 11

CHAPTER NO.: 2

SEC. NO.: 2.0

PAGE. NO.: 2-14 FIG./TABL:

COMMENT

Lithophysal tuff samples obtained from outcrop blocks are especially susceptible to weathering. Lithophysal tuff tested from outcrop samples may have very different properties than at depth.

REVIEWER: Frank Kendorski


Signature

ORGANIZATION: Dunn

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 12

CHAPTER NO.: 2

SEC. NO.: 2.0

PAGE. NO.: 2-14 FIG./TABL:

COMMENT

The DOE states that lithophysae are often larger than 5.7 cm in dimension. The DOE states that since lithophysae are often larger than the 6 cm of core, larger samples will be taken from the ES. Generally, samples should be 10 times larger than the defect to incorporate the defect into the sample in a general, and not local, perturbing, way. This means that 60 cm samples, as a minimum, need to be collected. This will probably be very difficult in the ES. The blasting is likely to result in much smaller fragmentation.

REVIEWER: Frank Kendorski


Signature

ORGANIZATION: Dunn

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 13

CHAPTER NO.: 2

SEC. NO.: 2.0

PAGE. NO.: 2-19 FIG./TABL:

COMMENT

The DOE has stepped from discussing the normal and shear behavior of fractures at large stress changes as being inelastic and non-linear to discussing general material behavior in the vicinity of underground openings where, for small stress changes, linear elastic material behavior "has been considered appropriate." The DOE has over-generalized, and over-simplified its argument here. The DOE finding is not referenced, whereas, the ones before (Goodman, 1980) and after (Zimmerman et al, 1986) are referenced. At low stress changes at low stress magnitudes, the rock mass does not behave elastically and linearly.

REVIEWER: Frank Kendorski

ORGANIZATION: Dunn


Signature

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 14

CHAPTER NO.: 2

SEC. NO.: 2.0

PAGE. NO.: 2-19 FIG./TABL:

COMMENT

The DOE states that elastic-plastic constitutive behavior is used for the tuff materials. Actually, rock and the rock mass are plastic-elastic-plastic. The first plastic regime is uncovered at low stress levels and is a result of initial joint, fracture or flaw movements that, due to slippage, are not recoverable.

REVIEWER: Frank Kendorski


Signature

ORGANIZATION: Dunn

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 15

CHAPTER NO.: 2

SEC. NO.: 2.0

PAGE. NO.: 2-20 FIG./TABL:

COMMENT

The DOE states that the ubiquitous joint model is appropriate because it assumes a single ubiquitous joint set and the Yucca Mountain tuff fractures are predominantly near-vertical. There has been very little joint mapping to justify this statement, and no real-world situation resembles the ubiquitous-joint model. There are at least two steep joint sets, necessitating the realization of 3-D behavior and multiple joint sets.

REVIEWER: Frank Kendorski


Signature

ORGANIZATION: Dunn

DATE: 06-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 16

CHAPTER NO.: 2

SEC. NO.: 2.1

PAGE. NO.: 11

FIG./TABL:

COMMENT

There is a possibility that groundwater may progress through the unsaturated tuff to the saturated tuff aquifer, thence, discharging into Franklin Lake Playa at Alkali Flats and may discharge at springs in Death Valley near Furnance Creek Ranch, or by evapotranspiration, contaminate Alkali Flats.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-14-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 17

CHAPTER NO.: 2

SEC. NO.: 2.3.3

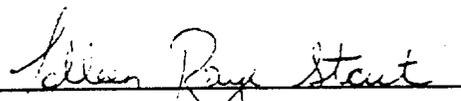
PAGE. NO.: 19

FIG./TABL: 2-3

COMMENT

It is stated that an important feature of the Yucca Mountain site is that its location is in the "unsaturated zone". It also states that the unsaturated zone at Yucca Mountain is thick enough to allow the construction of a repository about 660 to 1300 feet above the top of the water table. According to Figure 2-3, if the unsaturation zone is 660 to 1300 feet above the repository horizon envelope is proposed to be below the unsaturation zone. There appears to be a conflict in this information.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-13-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 18

CHAPTER NO.: 8

SEC. NO.: 3.1.2

PAGE. NO.: 3

FIG./TABL:

COMMENT

6th Paragraph down

The data used in modeling and the computational processes become at best a probability analysis. The difference between fracture permeability runs through several magnitudes. Faulted conditions can often increase this. Fracture-faulting conductivities will exceed a variation of 10 million times. Even in soils the variation between fine silt and coarse silt is 1000 times. It would seldom be possible to determine more than one significant figure in soil permeabilities. In fracture-faulting areas at best we can only roughly ascertain the power of ten involved. This report ignores this problem. Ground water is only a carrier, however we are interested in what it is carrying in terms of velocity, sorption and dispersion as examples. Much would need to be done to evaluate these factors.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: None

COMMENT NO.: 19

CHAPTER NO.: 8

SEC. NO.: 3.1.2-62

PAGE. NO.: 62

FIG./TABL: 8.3.1.2-2a

COMMENT

There appears to be no arrangement for accuracy criterion. Further there needs to be a program of sophisticated geostatistics. Geostatistical approaches specialize in furnishing the required information particularly for planning and evaluation of data.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 20

CHAPTER NO.: 8

SEC. NO.: 3.1.2

PAGE. NO.: 89

FIG./TABL:

COMMENT

Second Paragraph; Less than 1% of the rainfall enters the ground. These data on rainfall would not have a sufficient figure of accuracy to apply to the problem since even the second significant figure would be in doubt.

Third Paragraph: We do not have time for an adequate sampling program.

Fourth Paragraph: Only an adequate geostatistical study could decide the drilling program, now and in the future.

Fifth Paragraph: Boundary conditions studies will tell us virtually nothing about the flow above the water table at the site. Below the water table the flow of the ground water carrier will be almost entirely controlled by heterogeneity and anistropy.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 21

CHAPTER NO.: 8

SEC. NO.: 3.1.2

PAGE. NO.: 90

FIG./TABL:

COMMENT

Unsaturated Zone- Second Paragraph. Present day rates would have to be related to long term past and long term future rates. Here we have a completely inadequate sampling period.

Third Paragraph - Let us see the design of the geostatistical analysis to determine the value of this limited series of point measurements.

Top Paragraph Page 8.3.1.2-92 - The paragraph states quite clearly the complex conditions to be encountered. Confidence intervals for the measured data will have to be determined. The relationship for modeling would require a running evaluation of this interval. The type modelling suggested here would soon be seen to have little value for engineering purposes.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE-RW-199

AUTHOR: NONE

COMMENT NO.: 22

CHAPTER NO.: 8

SEC. NO.: 3.1.2

PAGE. NO.: 91

FIG./TABL:

COMMENT

Page 91- 4th Paragraph. Isotopic data would be highly desirable but the problem of mixing would have to be evaluated. This is a very heterogeneous region where mixing can be a major factor. Little data on heterogeneity is available for this area. Data not being available renders this approach indeterminate in fact, but does offer the best bet on long term predictions.

Page 92- 1st Paragraph. To make something scientifically defensible will be a difficult analysis when the mass of indeterminate data is considered. This also will present the question how long will be required to gather the required data.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 23

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 118 FIG./TABL:

COMMENT

Discussion in this section appears to discount the current transient state of groundwater. What is the baseline in the saturated system, and what changes are currently upstream from the repository vicinity? Then, what changes will be caused by aeration of the rock system during the mining activity? Are these changes likely to enhance downward percolation from the repository to the water table in the event of possible long term increases of water in the repository from whatever sources?

REVIEWER: DHD AHLEM

ORGANIZATION: SEA



Signature

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 24

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 120 FIG./TABL:

COMMENT

The apparent uncertainty on the reason for the large potentiometric surface gradient indicates insufficient understanding of the hydrogeology to make any state on the nature of the flowpath in the saturated environment. These studies make no mention of the final data density required to provide sufficient information to answer this type of question. With no direct statement of this coupling between performance assessment and data needs, we can assume that the final data array will be sufficient to evaluate structural vagaries and to evaluate impact on the estimation of travel-time.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE-RW-199

AUTHOR: NONE

COMMENT NO.: 25

CHAPTER NO.: 8

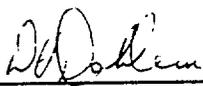
SEC. NO.: 3.1.2.

PAGE. NO.: 126-27 FIG./TABL:

COMMENT

Infiltration along Fortymile Wash may be very important in the regional groundwater recharge picture. I see no estimate on how sensitive the potentiometric surface fluctuation is to amount of recharge of infiltration. I cannot determine if the study in Fortymile Wash can yeild useful information other than a nice study to collect interesting information.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 26

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 134 FIG./TABL:

COMMENT

It appears that Landsat imagery may aid in phreatophyte mapping and therefore help correlate these data with structural features.

REVIEWER: D.H. DAHLEM

ORGANIZATION: SEA



Signature

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 27

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 161 FIG./TABL:

COMMENT

Geotomography probably cannot help describe the fracture network and structural interfaces with enough precision to understand structural control of the hydrogeologic system.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 28

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 169

FIG./TABL:

COMMENT

Natural rainfall variation may be significant. The tendency of averaging precipitation in desert regions over the year does not give adequate credit to the fact that the precipitation is strongly episodic. A few, very significant and infrequent storms account for all the precipitation, creating ponding, greater infiltration, and surface abundance of water not expected from yearly average rainfall.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 29

CHAPTER NO.: 8

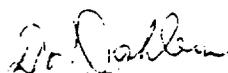
SEC. NO.: 3.1.2.

PAGE. NO.: 200 FIG./TABL:

COMMENT

Normal heterogeneity in the rock system may locally affect hydraulic properties such that estimates based on test plots and not specifically at the repository may be poor estimates.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 30

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 221 FIG./TABL:

COMMENT

Fault systems such as the Solitario Canyon structure are large scale features and may have different hydraulic characteristics from point to point on its' surface. These data collected at one location may have little bearing as an estimate or characterization of response. For instance, as the amount of brecciation changes along its' surface, the potential for change in hydraulic properties changes. As the attitude of the fault surface changes, the condition of stress across the fault changes and so also does the character of hydraulic isolation or conductance.

REVIEWER: D.H. DAHLEM



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 31

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 316 FIG./TABL:

COMMENT

Visual inspection may not be a sufficient indicator of the potential for perched water. The recent historical precipitation may be abnormal and recent structural condition may be abnormal.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 32

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 316 FIG./TABL:

COMMENT

Because the system is unsaturated, there may be no way to test the hydraulic properties of large-scale features like a fault in situ. With fault integrity potentially changing in time according to tectonism, this activity may be useless.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 33

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 351 FIG./TABL:

COMMENT

Apparently there is no feedback loop from modeling driving the amount or nature of data collection. Is performance of the system sensitive to the hydraulic parameters of the unsaturated zone system? If so, what parameters, and are they directly measured in these experiments? What are the acceptable ranges for data?

Testing program may be very complex and costly and yet not answer the question.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 34

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 353

FIG./TABL:

COMMENT

TBD's in the area of defining the codes, test methods, review and control (configuration) are not giving confidence the program has decided on a specific direction. How can the public review the worth of this work?

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 35

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 359

FIG./TABL:

COMMENT

I see no estimate of acceptability in this section. Given some experience with data and evaluation methods, what are your estimates of uncertainty? What is tolerable?

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 36

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 366 FIG./TABL:

COMMENT

With such a flat water table, how long will it take to provide a baseline. I don't see this addressed as a critical item such as at Hanford.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 37

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 367 FIG./TABL:

COMMENT

With such a low gradient down-gradient from the repository, how do you know the direction of flow. Is the downward migration along deep flow paths that would transport radionuclides into deep circulation cells and away from the repository area.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 38

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 369

FIG./TABL:

COMMENT

The fracture network beneath the repository will dominate liquid and radionuclide transport. The only viable way to assess this transport is by in situ testing, requiring boreholes. These boreholes will require seals which must remain active for 10,000 years, beyond current experience. How can you assess this system with sufficient precision and not cause a leaky environment?

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 39

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 441 FIG./TABL:

COMMENT

How will you show that pathways conceptualized for groundwater and radionuclide transport are actually appropriate for the geosphere containing the repository?

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 40

CHAPTER NO.: 8

SEC. NO.: 3.1.2.

PAGE. NO.: 441 FIG./TABL:

COMMENT

How will you show radionuclide flux transported; given that equilibrium partitioning into the fluid and between fluid and rocks will vary with time, chemistry, temperature, pressure?

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 41

CHAPTER NO.: 8

SEC. NO.: 3.1.2-2a

PAGE. NO.: 6

FIG./TABL: 8.3.1.2-2a

COMMENT

Data reduction models

Line 1

The rock matrix-hydrologic properties can be characterized by using classical statistical and geostatistical techniques as stated. We are unable to find application of these techniques (eg Kriging) to these problems. Since these offer the most powerful approach to data analysis it would be well to consider them. If geostatistical techniques cannot be applied, then anything else would do less and could furnish misleading information.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 42

CHAPTER NO.: 8

SEC. NO.: 3.1.2-2b

PAGE. NO.: 68

FIG./TABL: 8.3.1.2-2b

COMMENT

Table 8.3.1.2-2b encompasses virtually the entire field of groundwater hydrology. If this is a research proposal we must consider that the efforts on the subjects enumerated here are world wide and have been for many years. It would be difficult to see a competitive research effort at the site. If on the other hand it is an engineering proposal, it is a list of what we don't know which is also the entire field of hydrology. What we can do from an engineering standpoint must be evaluated to see if it furnishes the required conclusions realistically. The report tries to list every subject in hydrology. The report could be immensely reduced in size if we listed what we know and what we can do in the required short period of time. Accordingly the list of the indeterminate problems listed would be equally long.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 43

CHAPTER NO.: 8

SEC. NO.: 3.1.2.1.2.1

PAGE. NO.: 103

FIG./TABL:

COMMENT

Surface water runoff monitoring will require a period of sampling that will extend beyond any real decision making period. Data from such a program would be essentially useless without a 10-50 year sampling period. Since heavy rainfall is so sporadic in the area the 50 year period would more nearly be true. Criteria for statistical analysis have not been set for this project. In spite of this being of far reaching importance in environmental evaluation, the need for data as expressed here would be unsatisfactory even in a bridge design program.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 44

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2-2a

PAGE. NO.: 52

FIG./TABL: 8.3.1.2-2a

COMMENT

Stratigraphy

The column titled "Needed Confidence in Parameter or Performance Measure" will have to be quantitative. "Statistical Homogeneity" (Internal Geometry-stratigraphy) will not suffice since the heterogeneities go through several magnitudes (eg, 6) of parameter variation yet the needed confidence is obviously high as defined here.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 45

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2-2a

PAGE. NO.: 52

FIG./TABL: 8.3.1.2-2a

COMMENT

Pages 52, 53, 54

Internal Geometry

The description of the internal geometry in all cases are defined by a discontinuous, heterogeneous sets of data. This leads one to look for measurement techniques and evaluation measurements in the following report, they do not seem to be forthcoming.

On page 54 the top ROW describes the need for data on anisotropy. It apparently is not contained in the succeeding portions of the report. With the variation of parameter magnitudes defined here equivalent porous medium would not be a useful concept. To regard them as distinct hydrologic entities is to disregard the principle control on the flow system, the widely varying fracture system.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE-RW-199

AUTHOR: NONE

COMMENT NO.: 46

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2-2a

PAGE. NO.: 56

FIG./TABL: 3.1.2.2-2a

COMMENT

Driving Forces

Equation of Motion- 1st line

Permeability is a tensor (Dyadic Product) or is path controlled.
The driving force and flow vector are not parallel.

Conservation of Mass-

Much of the liquid in this system is essentially not moving. An important consideration in moisture logging by such devices as neutron logging. The liquid is contained in fracture systems that retard movement so severely as to not be part of any present phase of motion. Further from a volume standpoint the amount of liquid is very small. The liquid in storage being small does not change the probability of very high pressures at depth. Opening space at depth allows these high pressures to become high heads in the vicinity of the opening. Hence small volumes of water can exert extreme heads where the aquifer is disturbed.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 47

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2.9.3. PAGE. NO.: 356 FIG./TABL:

COMMENT

Required detail at the site could not be developed by boundary condition modeling. The emphasis in this type of modeling is on the control of the flow pattern by factors at a distance. The only value of such modeling would be furnishing a predictive vector at the site of the regional flow when modification of the regional flow occurred. The vector, even in this case, would not represent the local changes due to heterogeneity. We must keep sight of the fact that the local phenomenon are of prime concern not some gross average. The emphasis should be local. For accomplishing this boundary conditions must be for real and not due to synthesizing computer aids since they then become the control. There are no boundary conditions other than a flow description at a local boundary. It then would be necessary to make time a variable with very little data to determine such variations. It would be infinitely better to determine today's configuration by a non-subjective technique and then add the future changes by superposition.

Review: Federal Register Vol. 53, No. 247, pages 1983-1984 which essentially contradicts the approach shown here.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 48

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2.9.4

PAGE. NO.: 359

FIG./TABL:

COMMENT

Page 273, Item 6

This site analysis requires geostatistical evaluation. At the center of such analyses are kriging techniques. There is no consideration of such analyses. It is difficult to see how Monte Carlo simulations could be applied to evaluate such factors as:

1. Geometric Distribution of Permeability
2. Hydraulic Head Distribution
3. Anisotropy of Fractures
4. Required detail of Flow Patterns at the site

This is the domain of kriging techniques. Further, geometric distribution of the standard deviation of such parameters would be required to ascertain the planning of test wells. As it appears in the pages following page 359 the approaches used would lead to variances so great that in spite of high costs and effort the data would be so poor that safe decisions could not be made. I suggest the very elementary GEOEAS program of the EPA be reviewed. This program should be brought to a high technical level using the mathematics described in such publications as Geostatistical Ore Reserve Estimation by M. David, Elsevier Geostatistics-McGraw Hill, 1980, as well as a recent rash of publications on this subject.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 49

CHAPTER NO.: 8

SEC. NO.: 3.1.2.2.9.4.

PAGE. NO.: 359

FIG./TABL:

COMMENT

The statistical variations at this site are of a spatial nature. This requires an approach given by polygonal; inverse weighting; least squares or kriging. Since kriging is the most sophisticated approach and is readily available it would be senseless not to have it make up the center of the analysis program. See as an example Chapter 4 of Geostatistics, McGraw Hill, 1980. Throughout this report we can find no criterions or techniques that are useable to give the standard deviations on a geographic position, near or within the site. Today when Kriging is becoming one of the major thrusts in contaminant evaluation it is surprising that this major problem in data reliability is ignoring what will become, in the final analysis, a most important consideration.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 50

CHAPTER NO.: 8

SEC. NO.: 3.1.2.8-2a

PAGE. NO.: 54

FIG./TABL: 8.3.1.2-2a

COMMENT

Lateral Geometry

Eastward dipping Fault Blocks

The vertical downward gravitational force is applied through a tensor permeability or a path controlled permeability (Fracture Patterns). The permeability is therefore directional giving a flow pattern vertically downward. How much of these data will be available is hard to discern but it must be known or the remainder of the effort will be misleading.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

Signature

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 51

CHAPTER NO.: 8

SEC. NO.: 3.1.4.

PAGE. NO.: 17-18 FIG./TABL:

COMMENT

It is not apparent how the studies given in the final column of Table 8.3.1.4-2 will reduce uncertainty. The criteria for acceptance, the method of analysis, both appear to be TBD at this point for much of the program.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE-W-199

AUTHOR: NONE

COMMENT NO.: 52

CHAPTER NO.: 8

SEC. NO.: 3.1.16-31.

PAGE. NO.: 31

FIG./TABL: 8.3.1.16-3

COMMENT

Wells for construction water should not be on site because of the pathways problem. No discussion treats this issue.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 53

CHAPTER NO.: 3

SEC. NO.: 3.2.1

PAGE. NO.: 3

FIG./TABL:

COMMENT

An acceptable representation of the hydrologic considerations cannot be determined at this time. Data collection on flooding and stream flow in ephemeral stream channels throughout Nevada began in the early 1960's and stopped in 1980. Historical data was not collected in the region where the repository is proposed, until recently. The SCP notes that long-range flood predictions are difficult to make even for drainages that have stream flow records as long as 100 years, especially for extreme areal variability of flood flows in arid climates. The Squires and Young (1984) study is considered the best available method for determining the peak discharges and it is based on data from a short record period (15 to 20 years) which was from a "nearby" area. There has been no collection of historical data for infiltration through the unsaturated zones or recharge into the saturated zones.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 54

CHAPTER NO.: 8

SEC. NO.: 3.5.

PAGE. NO.: 14

FIG./TABL: 8.2.5.12-5

COMMENT

Section does not show transport across OT/CH nv or n2/TSW contacts, however faulting suggests there should be some exchange. This is conceptually important in pathway analysis.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 55

CHAPTER NO.: 8

SEC. NO.: 3.5.12.

PAGE. NO.: 5

FIG./TABL:

COMMENT

The statement in paragraph 3 suggests fracture flow should be discounted, however it is the only mechanism by which transport times will be sufficiently short to show the site unsuited. Therefore it deserves the utmost care and attention.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 56

CHAPTER NO.: 8

SEC. NO.: 3.5.12

PAGE. NO.: 6

FIG./TABL:

COMMENT

The strategy seems flawed because one system of network fractures could provide "all fracture" transport to the accessible environment.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 57

CHAPTER NO.: 8

SEC. NO.: 3.5.12-44

PAGE. NO.: 44

FIG./TABL:

COMMENT

The modeling approach is logical and accounts for the major processes however the inability to validate the calculations stemming from the lack of real data at the repository will make the estimates of travel time somewhat suspect.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 58

CHAPTER NO.: 8

SEC. NO.: 3.5.12

PAGE. NO.: 48

FIG./TABL:

COMMENT

Validation of the full system is not possible and any discussion of validation should be careful to point out which parts of the system are being validated and which parts are not. Then the discussion should treat the possible consequences from the subsystems not validated.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 59

CHAPTER NO.: 8

SEC. NO.: 3.5.12.

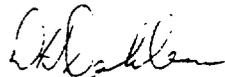
PAGE. NO.: 50

FIG./TABL:

COMMENT

All of this discussion relates to travel time, but mixed in is the concept of radionuclide transport. These should be kept separate. Radionuclide transport is probably somewhat slower and may be significantly slower than liquid water transport, given the sorbing and partitioning mechanisms extent in the tuff/glass rock assemblage.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 60

CHAPTER NO.: 8

SEC. NO.: 3.5.15

PAGE. NO.: 6 & 7 FIG./TABL:

COMMENT

The logic of protection assumes enough is known about the aquifers to say no inter-unit contamination will exist and essentially that no co-mingling between the surficial, tuff, and carbonate aquifer will happen. I believe insufficient data exists to make that point.

Technically DOE may not have to address the issue because a special source may not exist, but the State's position should be that if co-mingling cannot be dismissed, in the event dispersion may happen, the issue is not closed.

REVIEWER: D.H. Dahlem



Signature

ORGANIZATION: SEA

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 61

CHAPTER NO.: 3

SEC. NO.: 3.6.1

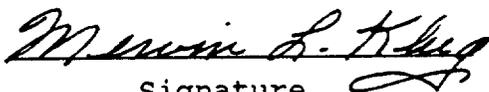
PAGE. NO.: 50

FIG./TABL:

COMMENT

The discussion of the hydrogeologic units presented in Section 6 reflects a complex ground-water system with limited available data. It appears that it will be difficult to obtain within a relatively short time frame the information needed to define conditions with much preciseness, even on a general site-specific basis.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 62

CHAPTER NO.: 3

SEC. NO.: 3.7.2

PAGE. NO.: 74

FIG./TABL:

COMMENT

Section 3.7.2 discusses principal ground-water flow paths and points to the lower carbonate aquifer as being the principal conduit to points of natural discharge. However, in much of the discussion reference is made to downward flow of water through volcanic-rock aquifers to reach the lower carbonate aquifer. If this is so, there must be some mechanism by which the water is able to get through the volcanic-rock aquitards. Elsewhere in the SCP these aquitards are inferred to be very restrictive to movement of water through them. Thus, it appears passage of water through aquitards needs additional study.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 63

CHAPTER NO.: 3

SEC. NO.: 3.7.3.1.2

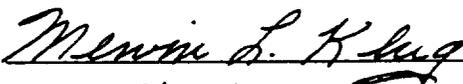
PAGE. NO.: 87

FIG./TABL:

COMMENT

The section on recharge and discharge mechanisms (3.7.3.1.2) makes frequent reference to place names in the region. There is no single map which shows these sites, and as a result it is not easy to follow the text and understand the mechanisms being described. Because of this, there are parts of this discussion which I do not understand sufficiently to comment on.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 64

CHAPTER NO.: 3

SEC. NO.: 3.9

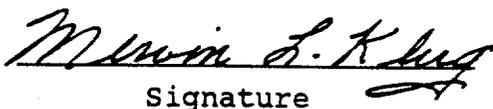
PAGE. NO.: 136 FIG./TABL:

COMMENT

Section 3.9 discusses the site hydrologic system and points out two things; its complexity and how little is known about it. The scientific community has only recently given much attention to the unsaturated zone, and very little of this attention has been concerned with volcanic rocks such as those at Yucca Mountain. Developing data useful in describing and evaluating these conditions at Yucca Mountain is for the most part exploring new territory. Doing this in connection with proving up a site for construction of a repository for high-level nuclear waste requires that it be done right. Therefore, new approaches should be completely understood and evaluated before using them to develop information at Yucca Mountain.

REVIEWER: MERVIN L. KLUG

ORGANIZATION: GUYTON ASSOCIATES


Signature

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 65

CHAPTER NO.: 3

SEC. NO.: 3.9

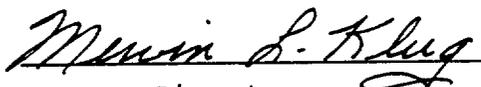
PAGE. NO.: 137 FIG./TABL:

COMMENT

The second paragraph on page 137 refers to potentiometric heads for rocks below the Topopah Springs and other upper hydrogeological units being greater than they are in the water-table aquifer. If water can leak downward from the water-table aquifer through volcanic-rock materials and enter the lower carbonate aquifer elsewhere in the region, there should be no reason why in this instance water cannot move upward into the water-table aquifer. The driving head for accomplishing this appears admittedly small, but some movement should be expected. If as indicated these conditions do exist, they need to be addressed in discussing flow paths and the mixing of waters.

REVIEWER: MERVIN L. KLUG

ORGANIZATION: GUYTON ASSOCIATES


Signature

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 66

CHAPTER NO.: 3

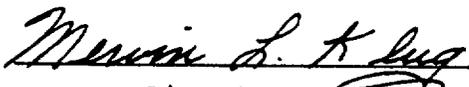
SEC. NO.: 3.9.3

PAGE. NO.: 196 FIG./TABL:

COMMENT

Under Item 8 on this page, the subject is temperature-driven moisture transport in the unsaturated Topopah Springs. If there is upward movement of water vapor, it appears this movement might transport radio-nuclides to the surface environment. This needs to be addressed as part of the SCP if this is not already done in another section. While this may not be a problem under pre-repository conditions, the heat generated from storage of the waste could have a major effect on vapor movement and transport.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 67

CHAPTER NO.: 3

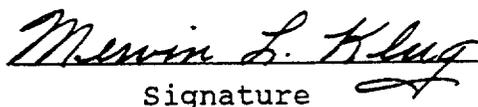
SEC. NO.: 3.9.3

PAGE. NO.: 197 FIG./TABL:

COMMENT

The fourth paragraph on this page discusses interaction of water in the shallow part of the saturated zone in the vicinity of the repository block with water in the deeper Paleozoic rocks. It says that ground water moving through the shallow part of the saturated zone probably does not have significant local interaction with water from Paleozoic rocks because water in the Paleozoic rocks has a higher potentiometric head. It appears that if the Paleozoic rocks have the higher potentiometric head, water from them should be entering and mixing with water in the shallow part of the saturated zone. This is not addressed.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 68

CHAPTER NO.: 3

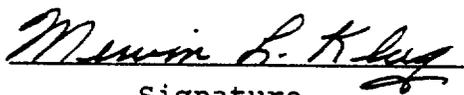
SEC. NO.: 3.9.4

PAGE. NO.: 215 FIG./TABL: 3-46

COMMENT

Figure 3-46 presents a conceptual hydrogeologic section from Solitario Canyon northwest of the site to Well J-13 in Jackass Flats. It is similar to other conceptual hydrogeologic sections presented in the SCP, and shows flow paths for water moving eastward from the Solitario Canyon end of the section. Elsewhere in the SCP statements are made that the Solitario Canyon fault shown at the left of the section forms a barrier to ground-water flow. Its displacement is shown to be from 20 to 200 meters. The question then is where does the water to support the flow path shown at the left of the section come from. Water-level contours presented in other figures of the SCP indicate there is flow across the fault. This inconsistency needs to be resolved.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 69

CHAPTER NO.: 3

SEC. NO.: 3.10.2

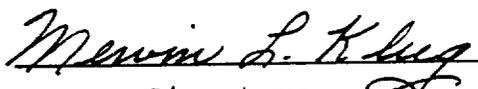
PAGE. NO.: 238

FIG./TABL:

COMMENT

The third paragraph on page 238 states that potential interaction between container walls and moisture in the emplacement holes is a consideration in estimating the lifetime of the canisters. It appears evident from the discussion presented in chapter 3 that moisture will be present in the host rock, whether in the rock matrix or through fractures. Therefore a matter of major concern is determining the amount and quality of the water and the engineering design required to protect against its presence.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: Reactivity of Tuff-Bearing Concrete
DOCUMENT NO.: LA-11532-MS AUTHOR: Los Alamos

COMMENT NO.: 70 CHAPTER NO.: 4

SEC. NO.: 4 PAGE. NO.: 63 FIG./TABL:

COMMENT

The results of just a few months of testing reveal the possibility of unpredictable mechanical properties due to the vitreous component of the tuff and the chemical activity of the glassy components. This will greatly affect the long-term performance of the repository seals.

REVIEWER: H. P. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-19-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: Reactivity of Tuff-Bearing Concrete
DOCUMENT NO.: LA-11532-MS AUTHOR: Los Alamos

COMMENT NO.: 71 CHAPTER NO.: 4

SEC. NO.: 4 PAGE. NO.: 63 FIG./TABL:

COMMENT

Since the host horizon is in the unsaturated tuff and the long-term forecast of elevated temperatures, it is very possible that the seals may be altered, which suggests the possibility or probability of contamination and leaks from the repository area to the saturated tuff.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-19-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: Reactivity of Tuff-Bearing Concrete
DOCUMENT NO.: LA-11532-MS AUTHOR: Los Alamos

COMMENT NO.: 72 CHAPTER NO.: 4

SEC. NO.: 4 PAGE. NO.: 63 FIG./TABL:

COMMENT

Although expansive cements are proposed or are being studied for use in the repository, subsequent to the hydrothermal experiments, the product "ettringite" was no longer found to be present in the samples. This "ettringite" is the prime product responsible for the expansive properties of the cement, and the concern over the loss of this product is that the concrete seal will shrink and crack in the same manner that normal portland cements perform. Without proper treatment of this property of concrete, the seals will be compromised to the extent that they may become virtually useless.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 6-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: Reactivity of a Tuff-Bearing Concrete
DOCUMENT NO.: LS-11532-MS AUTHOR: Los Alamos

COMMENT NO.: 73

CHAPTER NO.: 4

SEC. NO.: 4

PAGE. NO.: 64

FIG./TABL:

COMMENT

Another concern about the loss of the matrix phase "ettringite" is the release of sulfate to the groundwater causing an imbalance in the chemical activity which would encourage the increase in the permeability of the seal. Actually, the permeability may be compromised to a greater degree than nonexpansive cements due to the formation of interconnected needle-like crystals creating conduits for fluid transfer. This is the last thing we want to happen to seals and should precipitate the investigation for alternate seal mediums.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 6-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: Studies of Ancient Concrete
DOCUMENT NO.: LA-11527-MS AUTHOR: Los Alamos

COMMENT NO.: 74 CHAPTER NO.: 4

SEC. NO.: 4.2 PAGE. NO.: 57 FIG./TABL:

COMMENT

The surface conditions of the Yucca Mountain site may resemble the conditions of the investigation of the cementitious materials, but the near-surface conditions of the repository will vary considerably from the surface environment. Further, most all of the applications of the materials studied were used as a mortar to secure the basic building stones, which were the primary structural components of the feature.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-19-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 75

CHAPTER NO.: 4

SEC. NO.: 4.2.1.1

PAGE. NO.: 62

FIG./TABL:

COMMENT

I am concerned about the results of "flash floods" and the associated velocity of the runoff. Structures constructed in the path of these floods can be substantially damaged by not only the runoff, but more importantly, from large boulder impacts. Concentrating the runoff in diversion ditches only increases the velocity and danger as well as the possibility of undercutting the structure due to erosion.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-14-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 76

CHAPTER NO.: 4

SEC. NO.: 4.2.1.1

PAGE. NO.: 64

FIG./TABL:

COMMENT

Standby electrical power is mandatory for the safety of the workers; however, I am concerned about the protection of the generators from flash floods and rock impacts. The most probable time interval for the standby power will be during a violent storm which produce extensive runoff. The standby power equipment and service lines must be isolated from any possibility of damage.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-14-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-1098

AUTHOR: DOE

COMMENT NO.: 77

CHAPTER NO.: 4

SEC. NO.: 4.2.1.1

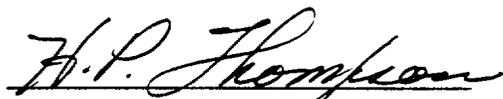
PAGE. NO.: 65

FIG./TABL:

COMMENT

The mining wastewater is proposed to be deposited into a settling and evaporation pond. It is unclear as to what provisions are being made for treatment of this wastewater due to contamination after the repository begins accepting HLNW for depositing in the horizon tuff. The continued construction of drifts will occur in the same time frame as the depositing of HLNW.

REVIEWER: H. P. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-14-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 78

CHAPTER NO.: 4

SEC. NO.: 4.2.1.1

PAGE. NO.: 65

FIG./TABL:

COMMENT

The shaft collar is constructed of reinforced concrete and provides a foundation for "supporting" the concrete liner of the shaft. If this is true and neglecting the sidewall friction, this collar must "hang" over 6,750 kips or 3,375 tons of concrete liner requiring a minimum of 112.5 square inches of G-60 steel calculated at the yield strength of a G-60 bar.

REVIEWER: H. P. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 79

CHAPTER NO.: 4

SEC. NO.: 4.2.1.2

PAGE. NO.: 67

FIG./TABL:

COMMENT

Placing the shaft concrete liner in 20-foot segments of unreinforced concrete does not meet ACI specifications. Further, there is no connection between segments for supporting the liner from the shaft collar. Shrinkage of the concrete in one 20-foot section may be as much or more than 3/16", and in the full length of the shaft as much or more than 10 1/2" depending upon the composition and design of the mix.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 80

CHAPTER NO.: 4

SEC. NO.: 4.4.7-3

PAGE. NO.: 335

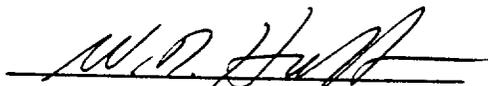
FIG./TABL:

COMMENT

The section titled Hydrologic Analysis (4.4.7-3) addresses regional floods as presented in a 1984 study performed by Squires and Young. The fifth (5th) paragraph of Section 4.4.7-3 states "the results of the study were considered in the siting of the surface facilities and in the conceptual design of the flood protection features," however, it goes on to say "no explicit design calculations were performed to support the conceptual design of flood protection features."

While it is not uncommon to use this approach on normal schedule projects, it appears this could be disastrous on a fast track project like the Yucca Mountain site where many studies and preliminary design work are proceeding based on anticipated locations and features, if later calculations raise questions on the results of the Squires and Young report.

REVIEWER: W. D. Huff



Signature

ORGANIZATION: Thompson Eng.

DATE: 05-23-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Overview
DOCUMENT NO.: DOE/RW-0198

AUTHOR: DOE

COMMENT NO.: 81

CHAPTER NO.: 5

SEC. NO.: 5.1.1

PAGE. NO.: 84&85 FIG./TABL:

COMMENT

In evaluating the repository system, all combinations of the three major events must be considered simultaneously and not just on an individual basis.

REVIEWER: H. P. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 82

CHAPTER NO.: 6

SEC. NO.: 6.1

PAGE. NO.: 71

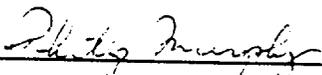
FIG./TABL:

COMMENT

Published literature also shows that structures can be designed to resist moderate surface displacement before any catastrophic failure could occur. There is no statement as to whether any of the planned structures are being considered for such a design.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 83

CHAPTER NO.: 6

SEC. NO.: 6.1

PAGE. NO.: 86

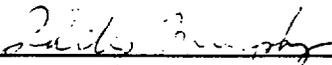
FIG./TABL:

COMMENT

Figure 6-12 is the overall site plan which shows the surface facilities and shafts. There is enough detail in the figure to illustrate the proposed locations of the electrical conduits, water lines, and a pipeline. There are also berms shown in the figure which presumably are for the purpose of diverting surface runoff away from the facility. If this is true, the berms in the area of the tuff pile need reexamination and the stream courses redrawn to their new location.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 84

CHAPTER NO.: 6

SEC. NO.: 6.1.1.2

PAGE. NO.: 8

FIG./TABL:

COMMENT

The DOE has established directives regarding the functional requirements of a repository. These directives consist of: 1) guidance and policy issued by the Office of Geologic Repositories for the Geologic Disposal of Radioactive Waste, and 2) requirements in the form of DOE orders that apply generally to all DOE projects and are written to establish policy and procedures for DOE activities. The directives are summarized in Table 6-4. The DOE and functional requirements developed from the directives are summarized in Table 6-5. The performance confirmation and closure phase functions and specific requirements are summarized in Table 6-6.

While the directives and functional requirements appear to be complete and comprehensive, I do not find a specific written procedure mechanism for their text to be changed, modified, expanded, or deleted based on findings of the site characterization. Changes most certainly will be required since this is the first repository designed for high level nuclear waste.

REVIEWER: W. D. Huff

ORGANIZATION: Thompson Eng.


Signature

DATE: 05-18-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 85

CHAPTER NO.: 6

SEC. NO.: 6.1.2.4

PAGE. NO.: 62

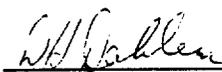
FIG./TABL:

COMMENT

Thermal properties may be affected by the degree of fracturing, the inhomogeneities in structure and mineralogy. These variations may be small, however their effect on design should be investigated. The statement that good agreement exists between lab and in situ valves should be qualified as an approximation.
(p6-62, #2)

REVIEWER: D.H. Dahlem

ORGANIZATION: SEA



Signature

DATE: 5/30/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 86

CHAPTER NO.: 6

SEC. NO.: 6.1.2.6

PAGE. NO.: 6

FIG./TABL:

COMMENT

It is noted herein that the flood plain limits established for the Yucca Mountain site are based on information from surrounding areas and not on site-specific characteristics. Since surface water drainage is a major consideration in establishing the site's suitability and several of the proposed facilities lie within or near the preliminary flood plain limits, it would be advisable to establish the probable maximum flood in accordance with ANSI/ANS 2.8(1981) at this time instead of waiting til later stages of design. This detailed study should include analysis of the flow through the existing draw in which the ESF facilities are proposed.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 87

CHAPTER NO.: 6

SEC. NO.: 6.2

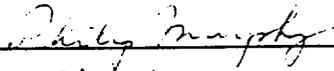
PAGE. NO.: 124 FIG./TABL:

COMMENT

A number of advantages for the choosing of this particular plan were mentioned. One reason was the protection from flash flooding. In comparing Figures 6-8 (pages 6-69) and Figures 6-48 (pages 6-125), the railroad yards and truck park are located in a flood prone area. Presumably the rail cars and trucks would still have waste containers onboard while in the yard and truck park.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 88

CHAPTER NO.: 6

SEC. NO.: 6.2

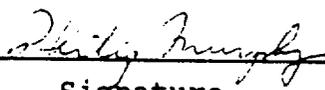
PAGE. NO.: 127 FIG./TABL:

COMMENT

The figure shows the locations of the six candidate areas for the surface facilities. The numbers go up to 8. Numbers 1 and 6 are missing.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 06-05-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 89

CHAPTER NO.: 6

SEC. NO.: 6.2

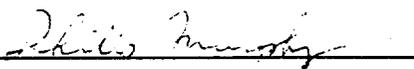
PAGE. NO.: 129 FIG./TABL:

COMMENT

Figure 6-51 shows the surface facilities of shaft sites. The water diversion cut on the south side needs a water course symbol drawn to show where the water will go. The same is true for the north diversion cut but some consideration must be given to divert the exiting water under the road leading to the explosive magazines rather than across it as presently drawn.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 90

CHAPTER NO.: 6

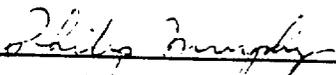
SEC. NO.: 6.2

PAGE. NO.: 134 FIG./TABL:

COMMENT

Flood protection structures should not only be designed for water but also for the erosive potential such floodwaters may have.

REVIEWER: Philip Murphy


Signature

ORGANIZATION: Dunn

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 91

CHAPTER NO.: 6

SEC. NO.: 6.2

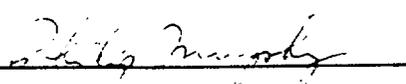
PAGE. NO.: 152 FIG./TABL:

COMMENT

Figure 6-65 shows the panel details for horizontal emplacement. At the top of the drawing the horizontal boreholes are specified to be drilled in 37 foot diameters, on 36 foot centers. The maximum height of the panel access drift is 14 feet. Some arithmetic adjustments are needed.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 92

CHAPTER NO.: 6

SEC. NO.: 6.2.3.1.1

PAGE. NO.: 89

FIG./TABL:

COMMENT

A question arises as to the expected site-generated radioactive waste volumes and whether a study is required to address the proposed off-site disposal contingency.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 93

CHAPTER NO.: 6

SEC. NO.: 6.2.3.1.1

PAGE. NO.: 6

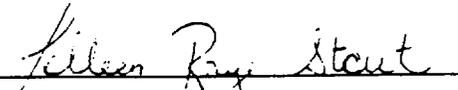
FIG./TABL: 6-15

COMMENT

In the waste-handling of the spent fuel, this section of the SCP notes that for both Phase I and Phase II, the spent fuel would be unloaded from the shipping cask and loaded into disposal containers where they would be filled with an inert gas sealed by welding and inspected for leaks. It does not specify how the original shipping casks are to be handled or disposed of once the hazardous material is unloaded, especially if they are contaminated. It just states they are to be returned to the carrier which will leave the repository.

REVIEWER: Colleen R. Stout

ORGANIZATION: Thompson Eng.


Signature

DATE: 06-14-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 94

CHAPTER NO.: 6

SEC. NO.: 6.2.3.1.2.2

PAGE. NO.: 6

FIG./TABL:

COMMENT

The figure showing emplacement of a waste package in a horizontal borehole shows a single canister being placed and not how multiple canisters are to be placed. Fourteen to eighteen containers are proposed to be placed in each horizontal borehole. It is not clear as to whether all the containers are to be placed at once and the shield plug is to be installed; or if they all place individually and the borehole remains open til it is full. It is also not clear as to whether the extension plate on the transporter is intended to push the container all the way back into the borehole (297 feet to 363 feet) or if the following containers placed push the previous ones back. If so, the container caps need to be designed for this force.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 95

CHAPTER NO.: 6

SEC. NO.: 6.2.3.1.3

PAGE. NO.: 6

FIG./TABL:

COMMENT

Mechanical equipment is proposed to unload, transfer, and seal the hazardous material as it arrives at the repository and prior to storage. It is not discussed how mechanical failures or repairs are to be handled.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 96

CHAPTER NO.: 6

SEC. NO.: 6.2.3.1.3

PAGE. NO.: 110

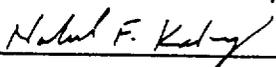
FIG./TABL:

COMMENT

An assessment of the impact of the equipment required that will provide the technical capability for accurately drilling and lining horizontal boreholes is needed at this stage. Since the design layout of the proposed repository is critically contingent on the availability of the technological capabilities to develop such equipment, it is deemed important that the capability to develop the equipment in question be demonstrated before any further thought to the waste-package emplacement methods.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 97

CHAPTER NO.: 6

SEC. NO.: 6.2.4.1

PAGE. NO.: 134

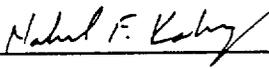
FIG./TABL:

COMMENT

Unless a more site-specific elaboration can be made on the soil characteristics concerning surface-facilities foundation design, the validity of the statement that measurements "can be considered conservative estimates for properties of the deeper foundation soils, because soil strength normally increases with confining pressure ... and depth," becomes questionable. Soil strength is not a function of depth but of soil properties.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 98

CHAPTER NO.: 6

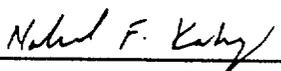
SEC. NO.: 6.2.6

PAGE. NO.: 148 FIG./TABL:

COMMENT

The description of the general layout of the vertical emplacement associated with standoff distances does not instill confidence in the performance objectives of the repository. The stated current design minimum standoff of 85 ft. was based on theoretically derived solution that may prove to be inaccurate once the site characterization activities are completed. An assessment of the impact of possible modification that might require an increase in this standoff distance on the overall repository performance and storage capacity is needed.

REVIEWER: Nahel F. Kabazi



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 99

CHAPTER NO.: 6

SEC. NO.: 6.2.6

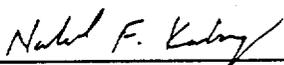
PAGE. NO.: 148 FIG./TABL:

COMMENT

In the process of describing the general layout of the horizontal emplacement, it stated that the panel would be 427 meters high. This is obviously a typographical error that should be corrected.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 100

CHAPTER NO.: 6

SEC. NO.: 6.2.6.2

PAGE. NO.: 164

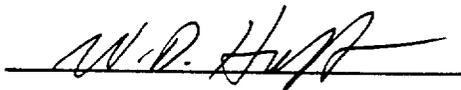
FIG./TABL:

COMMENT

It is stated in Section 6.2.6.2 that all underground areas would drain in the direction of a sump located in the bottom of the emplacement area exhaust shaft, the lowest point in the underground facility. From this location, the water would be pumped to the surface through the emplacement area exhaust shaft. Backup pumps would be available to ensure adequate pumping capacity.

Water being the critical concern of contamination transport, I feel this section falls short of adequately addressing the subject of groundwater control in the repository should it be encountered. What is the contingency plan for pumping should a serious event in the exhaust shaft render the primary and backup pumps inoperable, are there other pumps, could they sustain the potentially serious event that incapacitated the exhaust shaft pumps? Why not consider chamber doors in the drifts as a backup isolation method?

REVIEWER: W. D. Huff


Signature

ORGANIZATION: Thompson Eng.

DATE: 05-18-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 101

CHAPTER NO.: 6

SEC. NO.: 6.2.7.1

PAGE. NO.: 177 FIG./TABL:

COMMENT

At the current design stage with its inherent short comings based on lack of concrete data base, a statement concerning the backfilling of mined opening following emplacement can not be made with any confidence, as was the case here. The complexity of the repository's design with the different interrelated subsystems being simultaneously in the evaluation stage requires that each subsystem be evaluated based on its own technical and engineering merits. For example, the need for backfill as a means of structural support for mined openings before closure was discounted stating in the process that stability, if need be, will be provided by ground support system. But at the same time, the ground support system is at an evaluation stage of its own and might prove to have adverse effect on the repository's isolation performance objectives that deem it unusable.

It is not considered prudent to discount the possibility of backfilling based on the hope that the evaluation of ground support system's performance will prove to be acceptable.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 102

CHAPTER NO.: 6

SEC. NO.: 6.2.7.2

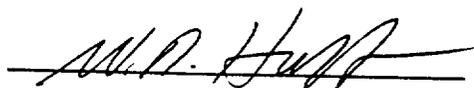
PAGE. NO.: 177 FIG./TABL:

COMMENT

Current planning for backfill at closure includes the use of water to control dust, improve compaction, or both. It is stated that limited quantities will be used with excess water being removed "the same as water introduced during development activities."

This is an inconsistent statement in that voids are being filled and closed, not created and opened, as during excavation when water can freely flow and be pumped. In fact, if optimum moisture content is maintained, why should there be excess water? Other mediums should be investigated, water is not the only dust suppressant or binder medium.

REVIEWER: W. D. Huff


Signature

ORGANIZATION: Thompson Eng.

DATE: 05-18-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 103

CHAPTER NO.: 6

SEC. NO.: 6.2.7.2

PAGE. NO.: 177 FIG./TABL:

COMMENT

Clarity as to the basis of assuming that the flux in the rock media is less than that of the hydraulic conductivity of the matrix is needed to verify the validity of the authors' reasoning to assume that the fractures "do not transmit water."

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 104

CHAPTER NO.: 6

SEC. NO.: 6.2.8

PAGE. NO.: 178 FIG./TABL:

COMMENT

One of the functions of the sealing system is to prevent or reduce the potential for creating a preferential pathway for ground water. Considering the fracturing (described in Chapter 1) and the potential for fracturing during excavation a preliminary design has been chosen for tunnel support. This very design will prevent any sealing system from extending beyond the tunnel support into the fractures around the tunnels or shafts. Figures 6-78 (page 6-180) and 6-79 (page 6-182) illustrate the seals extending beyond the walls of the tunnels and shafts but there is no mention made of making this a standard procedure in the text. Section 6.2.9 partly addresses this issue but only in isolating water bearing fractures and fault zones.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 105

CHAPTER NO.: 6

SEC. NO.: 6.2.8.2

PAGE. NO.: 6

FIG./TABL:

COMMENT

The shafts are proposed to be backfilled with a coarse, well-graded material to reduce settlement and to permit drainage of water. The proposed collars at the top of the shafts warrant careful considerations during construction to minimize impact to the surrounding rock wall's permeability. There is a potential for significant amounts of surface water to enter and fill the shafts over time if surface cracks or permeability is increased.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 106

CHAPTER NO.: 6

SEC. NO.: 6.4.2.2

PAGE. NO.: 221 FIG./TABL:

COMMENT

Section 6.4.2.2 titled Work Completed states "significant results have been reported to date for six products." Product 1.11.1-2 Reference Thermal/Mechanical Stratigraphy is one of the six listed. The first sentence of the second paragraph under the data section on pages 6-222 states "Specification of the accuracy of the model is difficult." The paragraph goes on to defend and soften this statement but concludes by saying "additional data collected during site characterization will be used to improve the confidence in the geometric model outside the primary area."

The purpose of the characterization program is to obtain data for site characterization, however, with such important information lacking in this area, I feel the initial accuracy statement on the model may be more accurate than the softened statement, which if true, will possibly effect the design schedule.

REVIEWER: W. D. Huff

ORGANIZATION: Thompson Eng.


Signature

DATE: 05-22-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 107

CHAPTER NO.: 6

SEC. NO.: 6.4.2.2

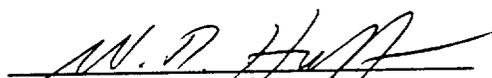
PAGE. NO.: 224 FIG./TABL:

COMMENT

Product 1.11.3-1 Area Needed Determination, one of the products for issue 1.11 appears to have the potential to impact the work done on other products in a very negative way. The three criteria used to calculate the area requirements do not list an identifiable contingency in the data section. Also, the results section list an uncertainty in the area needed of +-210 acres, based on uncertainty in the final basis APD of 40 to 80 kw/acre (appendix M of SNL, 1987). The current layout occupies 1420 acres. This is an approximate 15% ($210/1420 = .148$) unknown. I question what primary area the other product studies are being conducted on, especially the study on thermal/mechanical stratigraphy.

REVIEWER: W. D. Huff

ORGANIZATION: Thompson Eng.



Signature

DATE: 05-22-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 108

CHAPTER NO.: 6

SEC. NO.: 6.4.10

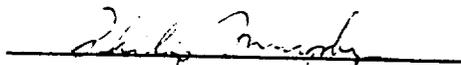
PAGE. NO.: 318 FIG./TABL:

COMMENT

The results of tunnel indexing or rock mass classification methods (CSIR and NGI) were applied to the waste emplacement horizon of Yucca Mountain. These results do not account for stresses caused by weapons testing or seismic events.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 109

CHAPTER NO.: 7

SEC. NO.: 7.2.1.3.3

PAGE. NO.: 16

FIG./TABL:

COMMENT

In the process of describing the waste form's temperature limitation criteria, a reference is made to a transition temperature without any further treatment of the subject matter. The need to address issues of specificity, when dealing with reference material, is obvious in this case.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 110

CHAPTER NO.:

SEC. NO.:

PAGE. NO.:

FIG./TABL:

COMMENT

The extent of the spent fuel storage testing program's duration in the process of determining the impact of the inert cover gas on the fuel and cladding degradation performance is required. For no matter how long the tests were, a certain degree of degradation will result with time that must be recognized, especially under such adverse performance conditions. Thus, it is critical that a new line of reasoning be taken to address the degradation potential of the fuel and the cladding.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 111

CHAPTER NO.: 7

SEC. NO.: 7.2.3.1

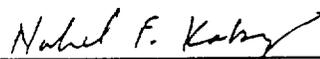
PAGE. NO.: 18

FIG./TABL:

COMMENT

The possibility of producing a waste form geometry that is considered "critical arrangement" is hinted upon during the discussion of criticality control but was relegated to a facilities and equipment controlled product status. The implication of accidental production of critical form assembly cannot be dismissed this easily, with no further attention to the specifics of the problem.

REVIEWER: Nahel F. Kabazi



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 112

CHAPTER NO.: 7

SEC. NO.: 7.3.1.1.1

PAGE. NO.: 24

FIG./TABL:

COMMENT

There is a need to address the procedural requirements to re-establish and incorporate the nonfuel hardware resulting from the preconsolidation operations and the structurally damaged "failed fuel" assemblies as they pertain to the reference fuel form. Also, an assessment study is required to address the failure to incorporate and provide for the aforementioned spent fuel forms (i.e., nonfuel and failed fuel) that may be received at the repository, during the conceptual design, for either the waste package or surface facilities and its impact on the overall repository storage objectives.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-20-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 113

CHAPTER NO.: 8

SEC. NO.: 8.0

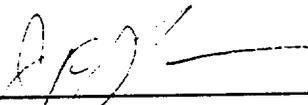
PAGE. NO.: 5

FIG./TABL:

COMMENT

It is stated throughout the SCP that the percolation of water through the unsaturated zone will primarily occur in the rock matrix. It is of the opinion of many hydrogeologists experienced with working in the unsaturated zone that the primary mechanism of flow will be through fractures.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 114

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 5

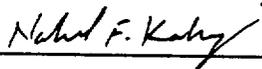
FIG./TABL:

COMMENT

Not until conclusive evidence supporting the suggested percolation patterns of water through the unsaturated rock matrix can the authors state that the water would be retained in the rock matrix and would not be expected to reach the waste. The scope of this project should not be based on suppositions and appearances.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 115

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 5

FIG./TABL:

COMMENT

"To reach the emplaced waste, the water would have to penetrate the engineered-barrier system."

Considering the life of the repository and the historical life of engineered-barrier systems, it appears that too much emphasis is placed on the ability of an engineered-barrier to isolate waste migration. It is my opinion that the engineered-barrier could be rendered useless in less than 300 years as a result of material behavior, tectonic events, etc. As a result, very little, if any, confidence can be placed on the engineered-barrier system.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 116

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 8

FIG./TABL:

COMMENT

With regard to the engineered-barrier system, the DOE has chosen to focus on three subjects at hand:

1. The air gap between the container and the rock.
2. The container.
3. The waste form.

First, the air gap is really not an engineered-barrier. Secondly, much concern is given towards the repository as a whole, namely, the arrangement of the drifts, shafts, and ramps; the thermal design of the repository layout; the design and construction of all planned seals and plugs; etc.

REVIEWER: James F. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 117

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 8

FIG./TABL:

COMMENT

Many statements are made to the tremendous time required for waste migration or water flux through the unsaturated zone. Such statements, if the flow predominately occurs through fractures, may prove false. Of concern is that not enough time exists for site characterization to prove or verify these travel times. Such tests simply require more time than is allowed within the program.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 118

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 9

FIG./TABL:

COMMENT

It is stated that the design of the repository is such that the repository itself will be able to withstand the expected seismic events in the Yucca Mountain region. It can be agreed that the repository will be able to remain functional as a normal "mining" facility after an extreme seismic event, but the engineered-barrier will very possibly fail. Seals and plugs may crack and the containers themselves may become damaged given a nominal seismic event. As a result, the engineered-barrier may be rendered useless.

REVIEWER: James F. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 119

CHAPTER NO.: 8

SEC. NO.: 8.0

PAGE. NO.: 9

FIG./TABL:

COMMENT

The SCP does state the priorities of the site characterization activities in this section, and it can be agreed that the priorities of the program are reasonably sound. However, of serious concern is that it is already assumed by the DOE that the site is suitable for a repository and that not enough time exists under the current schedule to fully test and evaluate the site. Such experiments and evaluations (such as within the unsaturated zone) really require a substantial amount of time: far greater than what is currently being allowed.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 120

CHAPTER NO.: 8

SEC. NO.: 8.1.2.3

PAGE. NO.: 11

FIG./TABL:

COMMENT

It is a point well taken that the site characterization program is extremely complex and comprehensive; still, some measure of performance assessment should be required. It is difficult to understand the logic behind the suggestion that the program elements would be evaluated individually with respect to adequacy of information obtained, when it is well known that the repository elements behave as coupled processes.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 121

CHAPTER NO.: 8

SEC. NO.: 8.3.1.1

PAGE. NO.: 4

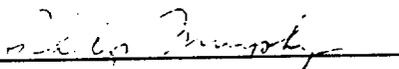
FIG./TABL:

COMMENT

It is true that various geologic processes observed at Yucca Mountain has been observed elsewhere. The main point, however, is not presenting these processes as common place but to address the issue of whether the combination of processes adversely affect the integrity and licensibility of the site to contain high-level nuclear waste.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 122

CHAPTER NO.: 8

SEC. NO.: 8.3.1.1

PAGE. NO.: 4

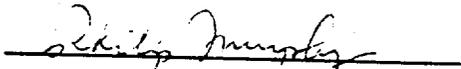
FIG./TABL:

COMMENT

I am not certain what is meant by the statement "In general, knowledge of the geologic setting constrains and provides confidence in local interpretations." Knowledge of the geologic setting provides hypotheses which can provide avenues of additional research for resolution or clarification. The more information there is, the narrower the interpretation and the greater the agreement.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 123

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2

PAGE. NO.: 4

FIG./TABL:

COMMENT

The top paragraph on this page states that untried and nonstandard approaches must be taken because of the inherently poor understanding of the hydrologic processes in thick, arid-region, fractured-rock unsaturated zones. It would be best to pursue these untried and nonstandard approaches separately from the SCP and to propose only those which are found to be applicable in resolving questions related to acceptability of the site. This would take more calendar time, but would result in the accumulation of reliable data upon which final decisions can be made without encumbering the record with false starts, unacceptable data, and incorrect conclusions.

REVIEWER: MERVIN L. KLUG

ORGANIZATION: GUYTON ASSOCIATES


Signature

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 124

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2

PAGE. NO.: 5

FIG./TABL: 8.3.1.2-1

COMMENT

8.3.1.2-1

The middle box should have at least the following added to it

2.0 Required statistical parameters for evaluation to determine if the data can be depended upon.

The lower box requires at least:

8.3.1.18 Evaluation of the statistical variance of parameters on the final conclusions

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 125

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2

PAGE. NO.: 7

FIG./TABL: 8.3.1.2-3

COMMENT

The problem of dispersive properties depends on the heterogeneity of the aquifer materials. There are no arrangements in the following pages to measure and analyze this functional control. After dispersion over a 1000 years the movement of the ground water as a carrier will be different, after encountering the heterogenous state of the aquifer, then would be a simple Darcian concept. Further ground water movement is only a carrier with a continually changing system of movement.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 126

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2

PAGE. NO.: 49

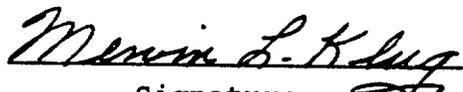
FIG./TABL:

COMMENT

The second and third paragraphs discuss applying multiple approaches to determining parameters not readily amenable to measurement or analysis, and to measure a parameter at different scales. I agree with this concept of developing confidence levels as long as the approaches have been proven acceptable and do not reflect experimental or untried procedures.

REVIEWER: MERVIN L. KLUG

ORGANIZATION: GUYTON ASSOCIATES


Signature

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 127

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2

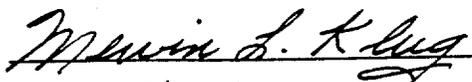
PAGE. NO.: 52

FIG./TABL:

COMMENT

The low rating for reducing uncertainty with regard to stratigraphy in Column 8 does not appear appropriate. Vertical coupling between stratigraphic units could destroy their ability to function as discrete hydrographic units as indicated in Column 3. If the sensitivity to alternate hypotheses is high as shown in Column 7 due to the bearing it has on calculating GWTT and radionuclide releases to the accessible environment, it is difficult to understand how using statistical methods based on completely random systems can produce results having a high confidence level. Thus, the need to reduce uncertainty should be shown as high in Column 8.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 128

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1

PAGE. NO.: 96

FIG./TABL:

COMMENT

Third Paragraph describes the fact that precipitation cannot be synthesized. But the hope of a data collection program doing so is hard to conceive since a period of about 50 years would be required. It is fortunate that precipitation data would not be necessary since its accuracy makes it irrelevant.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 129

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1

PAGE. NO.: 97

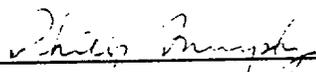
FIG./TABL:

COMMENT

Preferential recharge can also take place through fractures or fracture zones as well as faults. The infiltration model should take this into account.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 130

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.2.2

PAGE. NO.: 113

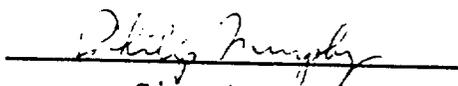
FIG./TABL:

COMMENT

Based on the site plan shown on Figure 6-12, a more careful examination now of the possible paths of debris flow can help in modifying the diversion structures and road courses to minimize damage resulting from debris flows.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 131

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.3

PAGE. NO.: 116

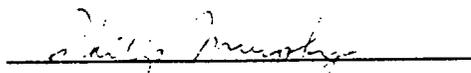
FIG./TABL:

COMMENT

Given the lack of knowledge about the Paleozoic carbonate rock, the deepening of USW WT-21 and WT-22 and the drilling of another hole, possibly upgradient of the site should be a certainty. The computer model will only yield results based on the input which should be as factual as reasonably possible.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 132

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.3

PAGE. NO.: 116

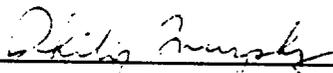
FIG./TABL:

COMMENT

A drillhole constructed into the Paleozoic units would not be able to yield information on direction of groundwater flow by itself. This information must be related with other holes or to other newly drilled holes.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 133

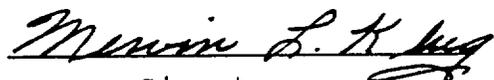
CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.3.2 PAGE. NO.: 118 FIG./TABL:

COMMENT

The last paragraph states that a general field reconnaissance will be conducted to locate previously unknown or unobserved wells, springs, and mine shafts that may yield information about regional ground-water levels. I fully agree with this. However, I am surprised this has not already been done. One of the first steps of a ground-water investigation is to collect all available data, including the making of a field inventory such as this. It appears the information would have been of value in the preparation of this SCP.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 134

CHAPTER NO.: 8

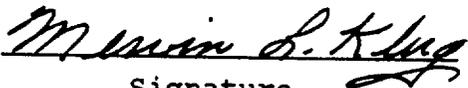
SEC. NO.: 8.3.1.2.1.3.2 PAGE. NO.: 120 FIG./TABL:

COMMENT

Reference is made to a Figure 3-1 in the third paragraph on this page. This illustration was not included in the SCP, or if so, it was not properly identified. A similar problem exists with regard to Figure 3-28 referred to in the last paragraph on this page, and earlier with reference to Figure 3-3 in the next to the last paragraph on Page 8.3.1.2-105.

REVIEWER: MERVIN L. KLUG

ORGANIZATION: GUYTON ASSOCIATES


Signature

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 135

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.3

PAGE. NO.: 120

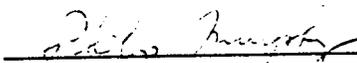
FIG./TABL:

COMMENT

Standard geophysical logs and examination of cuttings do not yield any quantitative determination of permeability. A qualitative determination can be made using spontaneous potential and a petrographic study of the cuttings.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP

DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 136

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.1.3.3

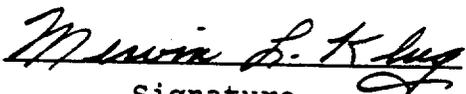
PAGE. NO.: 127

FIG./TABL:

COMMENT

The third and fourth paragraphs talk about drill holes for monitoring to estimate recharge along Fortymile Wash. The drill holes as shown by Figure 8.3.1.2-9 are apparently located along the wash, which means that only that portion of the recharge that moves directly downward will be monitored. It is possible that recharge moving downward through the alluvium will encounter bedrock and move laterally down-dip to fractures, faults, or other openings where it can again move downward. Thus, it would be desirable to have some offset drill holes to check on this possibility and provide control for determining the mechanics of recharge that might occur along the wash.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 137

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.2

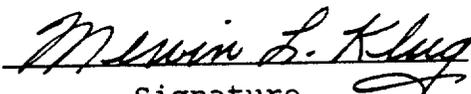
PAGE. NO.: 150

FIG./TABL:

COMMENT

The first full paragraph on this page talks about technical rationale for the investigation and says that prototype studies will be conducted. These prototype studies are not to be part of the site characterization investigation, but will be done to determine what can be done in an effort to characterize conditions at the site. These prototype studies are necessary, but they should already have been performed so the results could be reflected in the present SCP document. It might be difficult to integrate them into the SCP later on or to apply the results in a timely manner for reaching decisions about the adequacy of the proposed repository.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 138

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.2

PAGE. NO.: 151

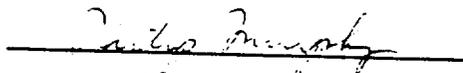
FIG./TABL:

COMMENT

A sequence of non-welded porous tuffs overlies the Topopah Springs Member probably forming a natural capillary barrier to retard the entrance of transient pulses of water into fractured tuffs. The state of knowledge of the site, however, does not preclude the possibility of an unmapped fault or fracture zone negating this conclusion.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.:

AUTHOR: DOE

COMMENT NO.: 139

CHAPTER NO.: 8

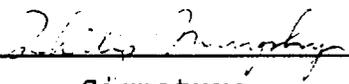
SEC. NO.: 8.3.1.2.2.3.3 PAGE. NO.: 223 FIG./TABL:

COMMENT

It is very difficult to run geophysical/video equipment into a horizontal hole. The 2-3 degree inclination would not be sufficient to overcome inertia and frictional forces and obtain readings through the entire length of the hole.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6/8/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 140

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.2.4.3

PAGE. NO.: 274

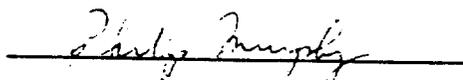
FIG./TABL:

COMMENT

The modeling of the repository horizon for permeability based on the results of air pressure should account for the difference in viscosity between air and water. The value of permeability of the rock with respect to water should be lower than that for air.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-08-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 141

CHAPTER NO.: 8

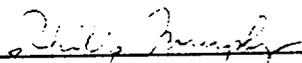
SEC. NO.: 8.3.1.2.2.4.10 PAGE. NO.: 318 FIG./TABL:

COMMENT

Any core taken for the purposes of measuring ambient moisture conditions will be subjected to heat and pressurized air mixed with a tracer. The heat will vaporize the natural moisture which will combine with the "tagged" air used in drilling. The tracer will be found in all samples, and especially in the smaller sized cuttings. The presence of tracer gas does not always indicate moisture.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn



Signature

DATE: 06-09-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 142

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.2.9.1 PAGE. NO.: 351 FIG./TABL:

COMMENT

The spatial distributions of the Parameters cited can only be statistical variables. The process of determining them should be so oriented. If at best the data are unreliable by a statistical analyses we should know it and plan accordingly.

Sampling sites will be expensive, there is no doubt, and accordingly data will be limited and expensive. However if it does not meet criterion for value in predictive analyses then we should acknowledge it and not ignore the fact or coverup the possible consequences. Data also can be irrelevant to the projected predictions even though we can measure it today.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP Review
DOCUMENT NO.: DOE/RW-199

AUTHOR: NONE

COMMENT NO.: 143

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.2.10

PAGE. NO.: 362

FIG./TABL:

COMMENT

The most important consideration here is an analysis of variances of the output data. Much of the data will be misleading to use without such an analysis. An analysis to determine the future data collection based on current needs is required. This will include an evaluation of the data requirements to reduce the standard deviation to a required figure. This figure should be explicitly decided. We must consider that the statistical variations are variations having a geometric function so that space is a variable. I believe that to fit the regulatory requirements of 40 CFR and 20 CFR a confidence interval must be set for each step in the process. Each step in the process should then be evaluated for how its accuracy will effect the final value. This is true since it is impossible to come up with a completely true result just how far can the result be from certainty. Is this acceptable in light of the legislative criterion. It probably will not be. What action to take is not then a technical problem instead it's a legal question.

REVIEWER: H.E. Skibitzke

ORGANIZATION: SEA

DATE: 5/30/89

Signature

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 144

CHAPTER NO.: 8

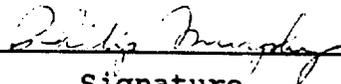
SEC. NO.: 8.3.1.2.3.1.5 PAGE. NO.: 403 FIG./TABL:

COMMENT

During drilling operations in the bedded salt deposits of the Texas Panhandle a tracer was added to the drilling fluids so the natural water and the fluids introduced by drilling could be distinguished. The wells were pumped but the tracer concentration in the samples never reached zero. Graphically the concentration asymptotically approached zero. The pumping may take longer than 4 weeks.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-09-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 145

CHAPTER NO.: 8

SEC. NO.: 8.3.1.2.4

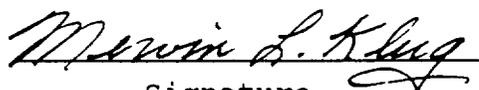
PAGE. NO.: 446

FIG./TABL: 8.3.1.2-32

COMMENT

This figure presents a schedule for the major events involved in site characterization. Very little is known about the geohydrologic system at Yucca Mountain after years of study by people involved in the project as well as by others associated with state and federal projects in the region. In view of the unknowns that are acknowledged, it is hard to conceive how sufficient and adequate data can be obtained and evaluated by 1995 for reaching decisions regarding the acceptability of the Yucca Mountain site as a repository for high-level nuclear wastes. This is less than 6 years from now. It appears construction of ES-1 should not begin until all the methods and related procedures proposed for characterizing geohydrology have been established.

REVIEWER: MERVIN L. KLUG


Signature

ORGANIZATION: GUYTON ASSOCIATES

DATE: 5-31-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 146

CHAPTER NO.: 8

SEC. NO.: 8.3.1.4.2

PAGE. NO.: 31

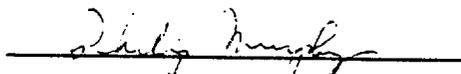
FIG./TABL:

COMMENT

Characterization of the vertical component of fractures can also be investigated by boring at an angle to the vertical. Close control would be needed during drilling to prevent excessive deviation of the hole from the planned angle.

REVIEWER: Philip Murphy

ORGANIZATION: Dunn


Signature

DATE: 6-09-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 147

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1

PAGE. NO.: 1

FIG./TABL:

COMMENT

The repository is planned to be designed (final design) and constructed in a phased manner. In other words, construction may begin on the site preparation while designs are being reviewed and approved for the underground networks, for example. This is not an unusual form of design\construction; however, as a result, the NRC, State of Nevada, and other overview entities will not have fully complete information in terms of design and construction documents before them while conducting reviews, etc.

It would certainly be preferable (although impossible in terms of the given time frame) to have a complete set of plans, specifications, and estimates, such that a complete review could be made of the ESF and the planned repository.

Due to the lack of complete information, the overview entities may not be able to fully access and review the planned construction activities.

REVIEWER: James F. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 149

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1

PAGE. NO.: 7

FIG./TABL:

COMMENT

Given the various design phases for the repository, it is unclear as to what interaction is given to the data obtained during site characterization with respect to design input. Much of the testing and studies conducted during the SCP is very important to the final design of the repository; yet, it is not clearly stated how the design of the repository will interact with the data obtained during the testing activities of site characterization.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 150

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1

PAGE. NO.: 13

FIG./TABL:

COMMENT

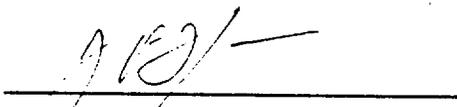
Discussions are made in this section of the SCP about the potential coupled processes that could occur within a repository. They have listed five general classes of processes that may in turn be coupled. These five classes are as follows:

1. Thermal
2. Hydrologic
3. Mechanical
4. Chemical
5. Radiological

It is admitted within the SCP that the reactions between these five processes can be tremendous under a given set of conditions and constraints. What is disturbing is that it is stated that since the number of processes can be very large, "Testing will, therefore, occur only if it is relevant to licensing arguments."

This puts a great deal of weight on the licensing arguments in terms of regional safety of the repository program. In other words, it should not be assumed that the licensing requirements have covered all of the potentially hazardous events that could occur.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 151

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1

PAGE. NO.: 18

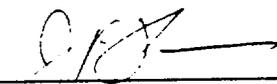
FIG./TABL:

COMMENT

It is disturbing that as stated in the SCP, "the goal of the Yucca Mountain Project is not an optimum design solution, but a design that has been optimized"

It is my opinion that the goal of this project is not to achieve only an "acceptable" design, but an optimum design. This form of goal, that the DOE has established, may very well be related to the phased construction/design proposed. After all, it may very well be impossible to achieve an optimum solution or design when not given proper site specific data to begin with. But, this could be an argument not to begin any detailed design of the repository until after all of the site characterization activities are completed and validated.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 152

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1

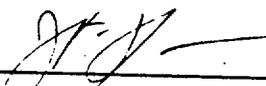
PAGE. NO.: 19

FIG./TABL:

COMMENT

It is understood that the design of the ESF and the repository will change or evolve as more site specific data are obtained; however, it is unclear as to the mechanism by which these design changes are employed. Of concern is that not enough input will be facilitated from both the NRC and the State during these design changes while construction is underway.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 153

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.2

PAGE. NO.: 13

FIG./TABL:

COMMENT

The controlling argument for conducting coupled interaction tests should be their relevancy to the repository design as well as to licensing.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 154

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.3

PAGE. NO.: 18

FIG./TABL:

COMMENT

The fifth (5th) paragraph of Section 8.3.2.1.3 titled "Design Improvement Activities and Tests" states "In arriving at a design with the preceding attributes, many trade off analyses will be required." Further into the paragraph it also states "cost and performance may also be traded off for each of the design choices."

As engineers, we all recognize the potential of having to consider trade offs in design, however, it concerns me that a project of this criticality has a written statement acknowledging the possibility of cost and performance trade offs without elaboration. I would suggest the site characterization plan statement is meant to say "low cost may have to be sacrificed for a higher performance design."

REVIEWER: W. D. Huff



Signature

ORGANIZATION: Thompson Eng.

DATE: 05-24-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 155

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.4.1

PAGE. NO.: 23

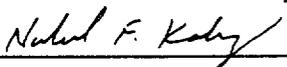
FIG./TABL:

COMMENT

There should be an effort to use finite-element techniques to analyze the thermomechanical processes as interactively coupled phenomenon instead of conducting the analysis of the processes in question as two separate events.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 156

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.4.1

PAGE. NO.: 1

FIG./TABL:

COMMENT

Performing multivariable interaction tests is relevant to licensing arguments only if performing those tests is necessary to characterize behavior to show compliance with regulatory criteria. If the investigation of any particular combination of processes does not aid in showing compliance with at least one regulatory criterion, then that investigation is not relevant, and testing to determine the behavior and effects of those coupled processes is not necessary.

The regulatory criteria was established 10 years ago and this is the first repository proposed. A possible investigation should not be ruled out automatically if it does not aid in showing compliance with the original regulatory criterion. It may address a significant consideration that was previously overlooked due to inexperience.

REVIEWER: Colleen R. Stout

ORGANIZATION: Thompson Eng.


Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 156

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.4.1

PAGE. NO.: 1

FIG./TABL:

COMMENT

Performing multivariable interaction tests is relevant to licensing arguments only if performing those tests is necessary to characterize behavior to show compliance with regulatory criteria. If the investigation of any particular combination of processes does not aid in showing compliance with at least one regulatory criterion, then that investigation is not relevant, and testing to determine the behavior and effects of those coupled processes is not necessary.

The regulatory criteria was established 10 years ago and this is the first repository proposed. A possible investigation should not be ruled out automatically if it does not aid in showing compliance with the original regulatory criterion. It may address a significant consideration that was previously overlooked due to inexperience.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 157

CHAPTER NO.: 8

SEC. NO.: 8.3.2.1.4.3

PAGE. NO.: 1

FIG./TABL:

COMMENT

The effects of condensation (or sweating) on the permeability of the rock walls exposed to the ventilation system is not proposed to be considered or tested. Such considerations may prove useful.

REVIEWER: Colleen R. Stout


Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 158

CHAPTER NO.: 8

SEC. NO.: 8.3.2.5.7

PAGE. NO.: 69

FIG./TABL:

COMMENT

There is a need to address the fact that the tunnel index methods employed in the underground repository facilities' structural-thermal analysis do not account for the effects of heat.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 159

CHAPTER NO.: 8

SEC. NO.: 8.3.2.5.7

PAGE. NO.: 69

FIG./TABL:

COMMENT

Even though the method for the empirical structural design of the shafts and ramps have not been selected, an outline of the methods under consideration should be included. Also, impact assessment of the possible design methods on the design of the repository's subsystems should be given consideration.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: Doe

COMMENT NO.: 160

CHAPTER NO.: 8

SEC. NO.: 8.3.2.5.7

PAGE. NO.: 71

FIG./TABL:

COMMENT

There is a need to address the possibility that the empirical design methods for the drifts would not be able to simulate or incorporate the thermal effects and the impact of such possibility on the overall direction of the program.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 161

CHAPTER NO.: 8

SEC. NO.: 8.3.2.5.7

PAGE. NO.: 73

FIG./TABL:

COMMENT

By practically eliminating the current ventilation analyses computer codes, there is an obvious need to define and identify the analysis codes that will be used in the License Application phase of the project.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 162

CHAPTER NO.: 8

SEC. NO.: 8.3.2.5.8

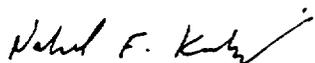
PAGE. NO.: 85

FIG./TABL:

COMMENT

A precise definition of the level of reasonability concerning the availability of construction, operation, closure, and decommissioning technology is needed. Fiscal, cyclical as well as confidence limit bounds should be set as a frame for defining the acceptable level of so called "reasonable availability of technology."

REVIEWER: Nahel F. Kabazi



Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
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AUTHOR: DOE

COMMENT NO.: 163

CHAPTER NO.: 8

SEC. NO.: 8.3.3.1

PAGE. NO.: 1

FIG./TABL:

COMMENT

The delay of the seal installation until closure is questionable. There will be boreholes within the perimeter of the repository that penetrate the saturated tuff, and the depositing of HLW during the active placement period may require the sealing of these borehole penetrations prior to closing the repository.

REVIEWER: H. P. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 6/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 164

CHAPTER NO.: 8

SEC. NO.: 8.3.3.1

PAGE. NO.: 3

FIG./TABL:

COMMENT

The probability that a seal cannot be developed that will meet the established goals is a distinct possibility. In that event, the HLW would have to be recovered and a great deal of expense will have occurred without any substantial return. By moving forward the deadline for developing an effective seal, this expense can be greatly reduced.

REVIEWER: H. P. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 6/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
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AUTHOR: DOE

COMMENT NO.: 165

CHAPTER NO.: 8

SEC. NO.: 8.3.3.1.2

PAGE. NO.: 7

FIG./TABL:

COMMENT

A more precise definition of performance acceptability limits pertaining to the temperature effects on the proposed clay and portland cement sealing material is needed. Stating that the sealing material "...may perform acceptably to temperatures as high as 250° C..." does not instill confidence in the thought process employed to arrive to such an all encompassing conclusion.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 166

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

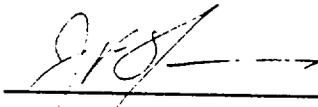
PAGE. NO.: 1

FIG./TABL:

COMMENT

An interesting issue, with the discussion of the seals within the SCP, is the concept of ensuring the seals do not become preferential pathways for fluid movement. Arguments for or against the use of seals, types of materials, etc., should not be focused towards determining if the seals will become pathways, but rather on what effect the seals will have on creating or perturbing preferential pathways. After all, a seal itself will not become a preferential pathway, but as a result of its placement, a pathway may be created in an unknown/unplanned location.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 167

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 6

FIG./TABL:

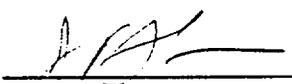
COMMENT

With regard to the seal materials utilized, the long-term effect of these seals given the various coupled processes at hand, may prove to be very difficult if not impossible to reasonably quantify.

Once again, the time frame allowed for such testing may not prove sufficient to accurately determine the adequacy of the sealing material and the resultant behavior of any seals proposed to be employed.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.



Signature

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
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AUTHOR: DOE

COMMENT NO.: 168

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 7

FIG./TABL:

COMMENT

The seals and plugs proposed within the ESF and repository can be generally considered pertinent to the elimination or reduction of water entering the repository. One of the major mechanisms of this intrusion of water is from surface waters. The seals may prove to route water, especially water due to infiltration through regions that were unplanned and unexpected. This is not really a phenomenal concept; yet, we should keep in mind that the seals and plugs of a repository, as stated in 10 CFR 60, are intended to generally pertain to repositories in the unsaturated zone.

If flows already exist in fractures, for example, a seal blocking that flow will cause a redistribution of the flows as the head builds within the fracture. As a result, new flow patterns may result that are more detrimental to waste isolation. Perhaps the solution to the concern with regard to the "seals" is to consider them more as drainage facilities - facilities that are designed and intended to route water away from the waste packages themselves and not seal them per se.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.


Signature

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
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AUTHOR: DOE

COMMENT NO.: 169

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 9

FIG./TABL: 8.3.3.2-1

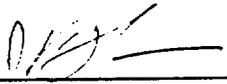
COMMENT

This table identifies several sealing components and lists many factors associated with the seals. Of interest, is that one of the design goals is to limit the surface water intrusion to 1700 m³/yr. from 0 to 500 years and 23000 m³/yr., thereafter.

Contrary to the other sections of the SCP, this section is planning for the potential of a substantial amount of water moving through the repository block.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.



Signature

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 170

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

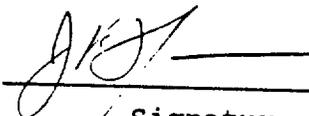
PAGE. NO.: 11

FIG./TABL: 8.3.3.2-1

COMMENT

One of the sealing components listed is backfilled material. This is proposed to be comprised of the tuff removed during the original mining operations. It is not really accurate to consider this material a fill. While providing a possible beneficial drainage mechanism, this fill material will do little to hinder water migration. The permeability of the host rock will be dramatically different than that of the fill material.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 171

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 25

FIG./TABL:

COMMENT

With respect to the anchor-to-bedrock plug/seals, it is anticipated that these seals will reduce the amount of water that enters the emplacement drifts. If the seal will be a cementitious material, such as concrete, as currently proposed, the shrinkage that will occur during hydration will cause a slight separation in places from the rock face. This is a normal phenomena and is typically expected. As water travels down the face of the shaft, adjacent to fill material, the seal or plug placed within the shaft may not hinder the water movement at all. This is why synthetic materials are utilized in conjunction with concrete plugs in underground structural design.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/19/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 172

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 25

FIG./TABL:

COMMENT

Having multiple barriers with possible introduction of performance redundancy might not be such an undesirable feature. The degree and magnitude of redundancy desired is more aptly to be the issue of concern.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 173

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 26

FIG./TABL:

COMMENT

An assessment of the impact of the proposed design, after its development, not meeting regulatory requirements needs to be addressed. At this point, reference is made to the effect that the design "may have to be modified..." to meet these requirements, but neglects to address the issue that a modified design may not be attainable.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 174

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 27

FIG./TABL:

COMMENT

The need to evaluate the uncertainties in both the performance goals and estimates of anticipated and unanticipated inflows should have been addressed at this stage of site characterization.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 175

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 29

FIG./TABL:

COMMENT

The constraint not to intersect the boreholes is contradictory to the overall design philosophy of the repository where the orientation and layout of the underground repository drifts dictated the location of the site characterization boreholes, as opposed to location of boreholes dictating and imposing a constraint on the layout of the repository. This statement should be revised to reflect, and be in line with, the general repository design philosophy.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 176

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 29

FIG./TABL:

COMMENT

From the discussions pertaining to the seals proposed within the repository, it is noted that much emphasis is put forth on "drainage." While this may prove prudent, it is interesting to note that a design goal is to "encourage vertical drainage of water through the drift floors."

As stated, this may be a good design goal; yet, the impacts of this performance on vertical emplacement may be severe. So severe, that the possibility of vertical emplacement may be dropped from further consideration.

REVIEWER: James F. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06/20/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
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AUTHOR: DOE

COMMENT NO.: 177

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

PAGE. NO.: 30

FIG./TABL:

COMMENT

In this section, it is stated that the ESF design and proposed construction methodology are intended to limit the uncertainties in three primary ways as listed. Listed below are comments to these three principals, respectively:

1. It can be argued that water inflow, due to infiltration and flooding, is a very potential problem as a result of the ESF being located in a wash.
2. Other construction methodologies would have a far better effect on controlling damaged zones than the blasting proposed.
3. The shaft liner, currently proposed to be unreinforced, may hinder the evaluation and testing of the rock permeability.

As a result, the conservatism employed is in question.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/20/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 178

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2

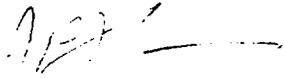
PAGE. NO.: 34

FIG./TABL:

COMMENT

An interesting aspect of the discussion related to the expected permeability of the fill material is related to a seismic event. An event of any nominal magnitude can have a significant effect on a granular fill. Once under vibration, the voids can be reduced or altered causing a redistribution of the flows within the fill. This is also related to the possibility of "excessive settlement" of the shaft fill.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/20/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 179

CHAPTER NO.: 8

SEC. NO.: 8.3.3.2.1

PAGE. NO.: 34

FIG./TABL:

COMMENT

There is still a requirement to develop and maintain an alternative parameter need for the other possible sealing material.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.

Nahel F. Kabazi

Signature

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 180

CHAPTER NO.: 8

SEC. NO.: 8.3.5.9

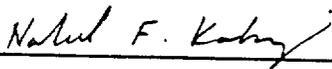
PAGE. NO.: 1

FIG./TABL:

COMMENT

An important question comes to mind as to the validity of the rationale used to arrive to the intended design life of the waste packages. We are left to wonder what to become of the waste packages after the 300 to 1000 yr. design life.

REVIEWER: Nahel F. Kabazi



Signature

ORGANIZATION: Thompson Engr.

DATE: 06-21-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 181

CHAPTER NO.: 8

SEC. NO.: 8.3.5.9

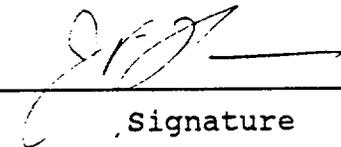
PAGE. NO.: 12

FIG./TABL:

COMMENT

It is stated in this section of the SCP that the heat generated by the waste will "raise the temperature of the host rock above the local boiling point of water" and will remain at that point for hundreds of years. This may indeed "dry out" much of the repository area, but of concern is this effect on the rock mass behavior and on the issue of retrievability itself. If, for whatever reason, retrieval is necessary, such high temperatures may make retrieval impossible.

REVIEWER: James F. Thompson


Signature

ORGANIZATION: Thompson Eng.

DATE: 06/20/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 182

CHAPTER NO.: 8

SEC. NO.: 8.3.5.11

PAGE. NO.: 4

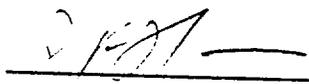
FIG./TABL:

COMMENT

A disappointment with the SCP is that little information is given pertaining to the results of tests conducted on the proposed seal materials, such as expansive cements. Los Alamos has published several documents recently which yield a tremendous amount of good information pertaining to the behavior of such cementitious materials (see other coments), but little appears to have been addressed within the SCP. After reviewing these other documents, it becomes quickly apparent that many of the proposed designs and materials will not function as planned (i.e. cements not having the expected expansion characteristics under high temperatures, etc.).

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.



Signature

DATE: 06/20/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 183

CHAPTER NO.: 8

SEC. NO.: 8.3.5.13

PAGE. NO.: 11

FIG./TABL:

COMMENT

The Cranwell methodology presented on Page 11 represents the CCDF as a weighted sum of conditional CCDF's. Using the mathematical notation developed in the background material, equation (2) of Hunter et al. (1986) reads:

$$G(m) = \sum_j G(m/s_j) P(s_j) \quad (8.3.5.13-6)$$

where:

s_j = A Designator for the j th "Scenario"

The discussion then goes on to say:

"Scenario is placed in quotation marks in the above definitions because the Cranwell methodology definition of the term apparently includes objects that are more general than the objects defined by this section's definition of scenario; the intended meaning of Hunter et al. (1986) appears to be closer to the term "scenario class"."

The use of the words "apparently," "intented," and "appears" in the above paragraph do not instill confidence in the reader that the formula is confidently understood.

REVIEWER: W. D. Huff



Signature

ORGANIZATION: Thompson Eng.

DATE: 05-30-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
TECHNICAL REVIEW COMMENT FORM

DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 185

CHAPTER NO.: 8

SEC. NO.: 8.4

PAGE. NO.: 1

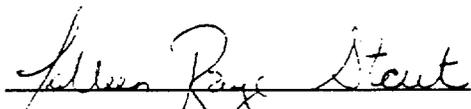
FIG./TABL: 8.4.1-3

COMMENT

The principal objectives, as specified for the technical criteria from 10CFR, do not include design consideration or protection from intentional accidents, explosions, or sabotage. Nor is it discussed as a consideration for Human Interference (Section 8.3.1.9) or Accidental Radiological Releases (Section 8.3.5.5).

REVIEWER: Colleen R. Stout

ORGANIZATION: Thompson Eng.


Signature

DATE: 06-15-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 186

CHAPTER NO.: 8

SEC. NO.: 8.4.1

PAGE. NO.: 2

FIG./TABL:

COMMENT

It is stated that as site characterization proceeds (especially with the ESF), the site specific data obtained will be utilized to modify the design and construction techniques employed. What is important to note, is that insufficient time exists from which to draw accurate conclusions about such site specific information, such as the hydraulic conductivity of the host rock. Such tests and evaluations take a very long time; and as such, it is questionable as to how much site specific data will be obtained that will effect the design and construction of the ESF, for example.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 186

CHAPTER NO.: 8

SEC. NO.: 8.4.1

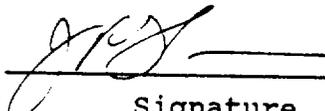
PAGE. NO.: 2

FIG./TABL:

COMMENT

It is stated that as site characterization proceeds (especially with the ESF), the site specific data obtained will be utilized to modify the design and construction techniques employed. What is important to note, is that insufficient time exists from which to draw accurate conclusions about such site specific information, such as the hydraulic conductivity of the host rock. Such tests and evaluations take a very long time; and as such, it is questionable as to how much site specific data will be obtained that will effect the design and construction of the ESF, for example.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 187

CHAPTER NO.: 8

SEC. NO.: 8.4.1

PAGE. NO.: 13

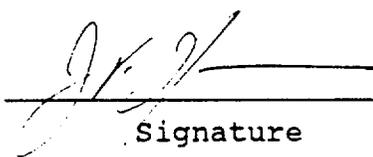
FIG./TABL:

COMMENT

As a result of the blast damaged zone around the openings in the ESF, increased flux may result from the creation of preferential pathways. The relationship between increased flux and preferential pathways is not an either/or situation.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.



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DATE: 06/21/89

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AUTHOR: DOE

COMMENT NO.: 188

CHAPTER NO.: 8

SEC. NO.: 8.4.1

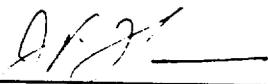
PAGE. NO.: 14

FIG./TABL:

COMMENT

Many of the hypotheses discussed herein are very sound in terms of technical integrity as related to the site characterization program. However, it is very important to note that one of the main underlying assumptions is that the hydraulic flux at Yucca Mountain predominately occurs through the rock matrix and not through fractures. If this is invalid, as it may very well be, then many of the discussions within this section lead to erroneous conclusions.

REVIEWER: James F. Thompson



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ORGANIZATION: Thompson Eng.

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AUTHOR: DOE

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SEC. NO.: 8.4.1

PAGE. NO.: 14

FIG./TABL:

COMMENT

Once again, it appears that a great deal of value is placed on the ability of the backfilled material to properly seal (in conjunction with the plugs) the shafts from surface water. The backfilled material may prove to hinder gaseous and vapor flow, but liquid flow may only be slightly effected. It appears premature to conclude that "water entering the backfill would be expected to be imbibed into the rock matrix."

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.


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DATE: 06/21/89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 190

CHAPTER NO.: 8

SEC. NO.: 8.4.1

PAGE. NO.: 16

FIG./TABL:

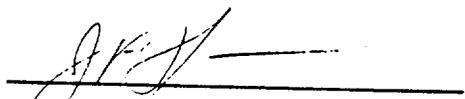
COMMENT

The first paragraph of this page concludes with a good discussion or rationale pertaining to water movement within the matrix in the unsaturated zone. Their following conclusion may be generally agreed with:

"Water stored within an unsaturated rock mass, therefore, would not be expected to move spontaneously into boreholes, drifts, shafts ..., or other openings whose diameters exceed the sizes of the pores. Movement into large openings requires additional external energy to initiate a transient change capable of causing such movement, such as increased infiltration or local heterogeneities and geometries that result in focused flow."

Since periodic increased infiltration rates are expected, and that the site as a whole is extremely heterogeneous, then it could logically be concluded that water will be expected to flow through fractures and into shafts, drifts, etc.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 191

CHAPTER NO.: 8

SEC. NO.: 8.4.1

PAGE. NO.: 18

FIG./TABL:

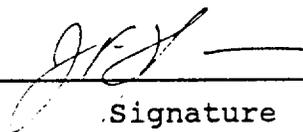
COMMENT

"... water movement in fractures may occur at sporadic locations where local saturations in the matrix material are high. While this sporadic flow in fractures may occur, the predominant flow in the unsaturated zone probably is through the matrix."

Considering one of the primary issues of the repository is to assess the potentially shortest time for waste migration to the accessible environment, it could be concluded that even if the flux at Yucca Mountain is predominantly through the matrix, the fastest path of migration would result from flow through fractures. As a result, the emphasis on fracture flow should not be belittled.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.


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DATE: 06/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 192

CHAPTER NO.: 8

SEC. NO.: 8.4.1

PAGE. NO.: 21

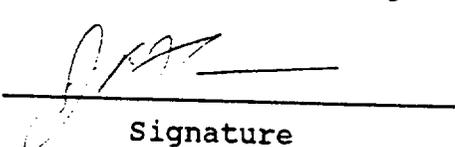
FIG./TABL:

COMMENT

In conclusion of this section (8.4.1), I was pleased to find the preparers of this section discuss the fundamental concepts of their assumptions and hypotheses pertaining to the hydrogeologic regime at Yucca Mountain. While all of these assumptions and hypotheses may not be agreed with, the frank manner in which the information was presented was appreciated.

This section concludes that it will be extremely important to access the hydrogeologic setting at Yucca Mountain during site characterization activities; yet, as stated previously, it is questionable if adequate data can be obtained given the relatively short time frame allowed for testing. In essence, the assumptions made may not be able to be verified.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 193

CHAPTER NO.: 8

SEC. NO.: 8.4.2

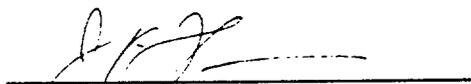
PAGE. NO.: 25

FIG./TABL:

COMMENT

With respect to the ESF location, discussions are made referring to the Bertram report and the five alternative ESF sites. It should be noted that the methodologies, as outlined in the Bertram report, used to "screen" the Yucca Mountain site, may not be fully agreed with. As a result, it is not assumed, as the SCP does, that the five alternate sites are the best potential sites within the repository block.

REVIEWER: James F. Thompson



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AUTHOR: DOE

COMMENT NO.: 194

CHAPTER NO.: 8

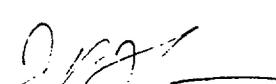
SEC. NO.: 8.4.2

PAGE. NO.: 151 FIG./TABL:

COMMENT

The ESF will eventually become a part of the repository (if the repository is constructed), and therefore, the ESF should be designed, licensed, and constructed under the same rigorous constraints as the repository itself. As such, it is questionable, due to the whole purpose of the ESF (a means of obtaining site specific data), that the ESF will be able to be designed and constructed with the same degree of confidence as the repository in terms of waste isolation. This is really not a function of "design control;" but rather, a function of the fact that pertinent site specific data is not available for the design and construction of the ESF.

REVIEWER: James F. Thompson



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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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AUTHOR: DOE

COMMENT NO.: 195

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 153

FIG./TABL:

COMMENT

While it is stated that reports, plans, and specifications are in the various stages of preparation for the ESF, no mention is made of the vital calculations used for the design of the ESF. While it is true that the NRC and the State of Nevada are involved with the technical review of the ESF, this review cannot be made complete without the detailed calculations that were performed to determine the details of the design.

To date, the reports and plans provided to the State have not yielded sufficient information to form any solid conclusions.

REVIEWER: James F. Thompson



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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 196

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 167 FIG./TABL:

COMMENT

As noted within this section of the SCP, only one hoist house has been planned for both shafts. It would seem prudent to have two hoist houses to account or facilitate fire protection. This would aid in the assurance that at least one shaft could remain operational in the event of a fire.

REVIEWER: James F. Thompson


/Signature

ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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AUTHOR: DOE

COMMENT NO.: 197

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 169

FIG./TABL:

COMMENT

The statement that the "surface topography allows proper drainage" may prove false given the uncertain hydrologic history at Yucca Mountain. In addition, without proper modeling of the improvements proposed within the wash, it cannot be concluded that no danger of surface flooding exists.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 198

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 188 FIG./TABL:

COMMENT

It is stated that the shaft liners will be unreinforced, although no justification for this action is given (it is assumed to ease removal of the liner). Several problems arise with the construction of the liner without any reinforcing:

1. This is in violation of the ACI code pertaining to such designs.
2. No reinforcement can allow for much shrinkage and resultant cracking depending on the mix design.
3. A round opening, such as the shaft, can be considered to have a uniform loading (such a loading may not even exist in this environment). Under this loading scenario, each section of the liner will be in compression. However, during a seismic event, differential deformation or loading may take place that would cause some faces of the liner to be in tension. With no reinforcement, a structural failure would be likely since concrete has very little tension strength.

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 199

CHAPTER NO.: 8

SEC. NO.: 8.4.2

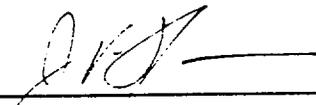
PAGE. NO.: 205

FIG./TABL:

COMMENT

Much speculation is given to the elastic behavior of the rock mass. In previously published study plans, the blast damaged zone, for example, was expected to be limited to three times the diameter of the opening; yet, now this has evidently been changed to two times the diameter. No discussion is given to explain this change in design.

REVIEWER: James F. Thompson



Signature

ORGANIZATION: Thompson Eng.

DATE: 06/23/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 200

CHAPTER NO.: 8

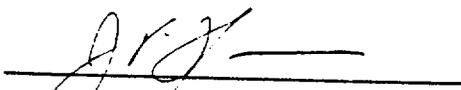
SEC. NO.: 8.4.2

PAGE. NO.: 205 FIG./TABL:

COMMENT

It is anticipated that elastic analysis will approximate the behavior of the rock mass. Due to the inherent mass characteristic of the rock, it is doubtful that an elastic analysis will accurately predict the behavior from a total system standpoint. It is even stated that "Where rock movement and loosening along joints was evident, measured displacements ranged from 3 to 10 times the predicted elastic displacements." Even after such a comment is made, the conclusion is made that "elastic analyses will provide good estimates of rock behavior near excavations."

REVIEWER: James F. Thompson


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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 201

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 207 FIG./TABL:

COMMENT

The statement that "From this testing, the fractures were found to be tighter after excavation than before, in most places near the excavation," should not be misinterpreted to imply that the blasting conducted during excavation will have a positive effect on the permeability of the host rock. While some fractures will close or become "tighter" after excavation, many other fractures will be mitigated and perturbed near the excavation.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.



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DATE: 06/21/89

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AUTHOR: DOE

COMMENT NO.: 202

CHAPTER NO.: 8

SEC. NO.: 8.4.2

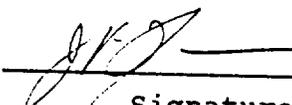
PAGE. NO.: 209

FIG./TABL: 8.4.2.39

COMMENT

With respect to the two-drift-standoff, this figure illustrates the potential for problems if it is discovered that the blast damaged zone is more extensive than anticipated. It is stated that the design has allowed for flexibility in the test position, orientation, etc.; however, it is apparent that insufficient area will exist at the main test level should the disturbed zone extend farther than currently planned (as previously estimated).

REVIEWER: James F. Thompson



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ORGANIZATION: Thompson Eng.

DATE: 06/21/89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 203

CHAPTER NO.: 8

SEC. NO.: 8.4.2

PAGE. NO.: 210 FIG./TABL:

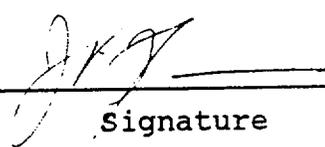
COMMENT

It is evident that the Heated Block Test and the Canister Scale Heater Test will have thermal (and perhaps stress altered) zones of influence that overlap. Of concern is the resultant representativeness of data obtained from these experiments as a result of their close proximity to each other.

REVIEWER: James F. Thompson

ORGANIZATION: Thompson Eng.

DATE: 06/21/89


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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 204

CHAPTER NO.: 8

SEC. NO.: 8.4.2.1.3.2

PAGE. NO.: 17

FIG./TABL:

COMMENT

The effect of the proposed excavation process and rock mass exposure to the atmospheric conditions will in fact alter the in situ ambient conditions and may extend beyond the hypothesized local zone of disturbance or alteration. The impact of such possibilities on the large-scale hydrologic, thermal, and mechanical in situ conditions needs to be accounted for.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 205

CHAPTER NO.: 8

SEC. NO.: 8.4.2.1.6.1

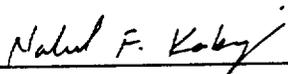
PAGE. NO.: 35

FIG./TABL:

COMMENT

If a possibility exists, as is the case here, for conducting in situ test in the Calico Hills nonwelded unit, then the need to address this issue at this stage of site characterization is present.

REVIEWER: Nahel F. Kabazi



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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 206

CHAPTER NO.: 8

SEC. NO.: 8.4.2.2.2.2

PAGE. NO.: 64

FIG./TABL:

COMMENT

Rewording or rework of this statement concerning the location of the unsaturated-zone, multipurpose, and systematic drilling program boreholes is needed. An ambiguity exists here as to location of the boreholes where one of the interpretation would be a requirement to place the drill holes as close to the minimum separation from the nearest drift as practicable.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

Signature

ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 207

CHAPTER NO.: 8

SEC. NO.: 8.4.2.2.2.2

PAGE. NO.: 75

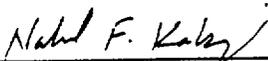
FIG./TABL:

COMMENT

An attempt to define the drilling method for the Systematic Drilling Program should be made. An understanding of the magnitude of hydrologic and hydrochemical disturbance introduced by the technologically available drilling options needs to be developed.

REVIEWER: Nahel F. Kabazi

ORGANIZATION: Thompson Eng.



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DATE: 06-16-89

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AUTHOR: DOE

COMMENT NO.: 208

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.1

PAGE. NO.: 144

FIG./TABL:

COMMENT

Air borehole drilling for the purpose of minimizing changes in the ambient moisture conditions during the characterization process needs further addressing. Bound limits for the change of ambient conditions need to be defined such that the relative allowable changes expected are delineated and the limiting boundary values that render the data "scientifically acceptable" are clearly developed.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 209

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.1

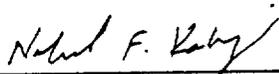
PAGE. NO.: 145

FIG./TABL:

COMMENT

Penetration of air and water into the surrounding rock regions of the faults' hydrological characterization cannot be based on assumption which in turn are based on expectations. An analytically based simulation model is deemed appropriate for such characterization of fault zone permeability.

REVIEWER: Nahel F. Kabazi



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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 210

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.3.3

PAGE. NO.: 167

FIG./TABL:

COMMENT

An accurate representation of the schematic cross section drawing of the exploratory shafts 1 and 2 needs to reflect the total sinking depth in relative terms consistent with stated numerical values.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 211

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.3.3

PAGE. NO.: 169

FIG./TABL:

COMMENT

A statement concerning the confidence in the Hydraulic isolation characteristics associated with the operational consideration in the development of the general arrangement of the Exploratory Shafts is prudent at this stage, since it can't be conclusively demonstrated.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi

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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 212

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.6.1

PAGE. NO.: 205

FIG./TABL:

COMMENT

An outright discount of the effects of the discontinuous nature of jointed rock could prove critical to the overall performance of the ESF. It is crucial that an effort, on the part of the people involved in conducting the structural analysis calculations to support the design of the ESF underground excavations, be made to account for such a phenomenon.

REVIEWER: Nahel F. Kabazi

Nahel F. Kabazi
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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

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DOCUMENT TITLE: SCP
DOCUMENT NO.: DOE/RW-0199

AUTHOR: DOE

COMMENT NO.: 213

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.6.1

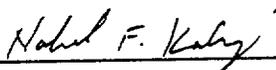
PAGE. NO.: 207

FIG./TABL:

COMMENT

In stating that "From this testing, the fractures were found to be tighter after excavation than before," the statement seems somewhat ambiguous as to the conclusion to be drawn. Also, it is difficult to understand how the aperture of fractures became tighter after excavation but still the hydraulic quotient exhibited a characteristic increase in magnitude.

REVIEWER: Nahel F. Kabazi


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ORGANIZATION: Thompson Eng.

DATE: 06-16-89

NEVADA NUCLEAR WASTE PROJECT OFFICE
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COMMENT NO.: 214

CHAPTER NO.: 8

SEC. NO.: 8.4.2.3.6.3

PAGE. NO.: 216

FIG./TABL:

COMMENT

The fact that a detailed description of the ESF in Chapter 6 evaluations does not rectify the statement made in this section. Up to this point the reader is left with the impression that the proposed ES1 and ES2 have different dimensions. There should have been a effort on the part of the responsible parties involved with this project to bring this discrepancy up much earlier, and possibly go as far as rewriting the pertinent section concerning the dimensions of ES-2.

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AUTHOR: DOE

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CHAPTER NO.: 8

SEC. NO.: 8.4.3

PAGE. NO.: 34

FIG./TABL:

COMMENT

A more precise definition of the term "to the extent practical" needs to be given. With the way the design is being carried out at this stage, given the constant revision, modification, and preliminary nature of the repository layout, it is evident that a more accurate coordination of the proposed drillholes' locations with respect to the general repository's layout needs to be conducted.

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SEC. NO.: 8.4.3.2.1.2

PAGE. NO.: 15

FIG./TABL:

COMMENT

The extent of water-polymer mixture migration experienced during the drilling of USW G-1 needs to be determined. Also, the effect of the migratory pattern of this water-polymer mixture on the Site Characterization activities needs to be addressed.

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SEC. NO.: 8.4.3.2.1.4

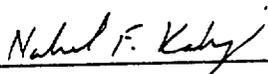
PAGE. NO.: 19

FIG./TABL:

COMMENT

An accurate delineation of the phenomenon of water-vapor flow in an open borehole needs to be addressed. Presumptive conclusions as to the magnitude of the air flow are inadequate. A more detailed treatment of the nature of the excess air flows and the driving mechanisms are needed at this juncture.

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PAGE. NO.: 29

FIG./TABL:

COMMENT

A definitive statement is more appropriate concerning the possibility of localized failure for the vertical emplacement drifts. Stating that the crown rock could be stabilized with ground support shows the inadequacy of the design thought, especially knowing that the ground support system itself is in the characterization design stage and has not been finalized.

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CHAPTER NO.: 8

SEC. NO.: 8.4.3.2.3.2

PAGE. NO.: 32

FIG./TABL:

COMMENT

This section addresses the analyses conducted in support of the excavation investigation and the effects of shaft convergence, demonstration breakout rooms, and sequential drift mining. It goes on to mention that "at the time of analysis, only one access drift was planned,....." without reference to any further analytical investigations planned to rectify their outright conclusion that the analysis carried out for one access drift is representative of that for three. It is critical that an analysis be carried out reflecting the more current proposal of three drifts.

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