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NNWSI PROJECT

Nevada
Nuclear Waste
Storage Investigations Project

TECTONIC STABILITY AND EXPECTED GROUND MOTION AT YUCCA MOUNTAIN

Report of a workshop at SAIC - La Jolla
August 7-8, 1984

PRELIMINARY REPORT

October 2, 1984

TECHNICAL & MANAGEMENT SUPPORT SERVICES
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Prepared for:

U.S. Department of Energy
Nevada Waste Management Project Office

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2769 South Highland Drive
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ABSTRACT

A workshop was convened on August 7-8, 1984 at the direction of DOE to discuss effects of natural and artificial earthquakes and associated ground motion as related to siting of a high-level radioactive waste (HLW) repossitory at Yucca Mountain, Nevada. A panel of experts in seismology and tectonics was assembled to review available data and analyses and to assess conflicting opinions on geological and seismologic data. The workshop participants were representatives from the DOE/NV Waste Management Project Office, Science Applications, Inc., U.S. Geological Survey, Sandia National Laboratories, and John Bluem and Associates. The panel of experts consisted of Dr. W. F. Brace (MIT), G. A. Frazier (Center for Seismic Studies), H. R. Pratt (Science Applications, Inc.), R. B. Smith (University of Utah), B. P. Wernicke (Harvard University), and C. B. Raleigh (Lamont Doherty Geological Observatory. All workshop participants are listed in Appendix 1.

The objective of the meeting was to advise the Nevada Nuclear Waste Storage Investigations (NNWSI) Project about how to present a technically balanced and scientifically credible evaluation of Yucca Mountain for the NNWSI Project EA.

The group considered two central issues: (1) the magnitude of ground motion at Yucca Mountain due to the largest expected earthquake, and (2) the overall tectonic stability of the site given the current geologic and seismologic data base. To focus the discussion, Drs. W. F. Brace and G. A. Frazier rised a series of questions about each issue, as given below. The group examined each question and prepared responses, which often included major recommendations for more geologic or seismologic studies. These responses have been edited by Drs. Brace, Frazier and Pratt and are compiled in this report. A more complete document with detailed recommendations will be published at a future date.

EXECUTIVE SUMMARY

- In situ stress measurements at Yucca Mountain neither rule out, nor are strong evidence for an impending major earthquake near the site. Other regions in the United States have similar stress conditions and are completely aseismic.

- Crustal extension rates inferred from contemporary seismicity and Quaternary geologic slip rates in the Basin and Range province can not yet provide detailed recurrence intervals for earthquakes at Yucca Mountain. Limitations preclude an accurate assessment using this method to the limited area of Yucca Mountain primarily because of a short historical seismic record and a lack of detailed slip rate data in the immediate site vicinity.

- There is a high probability that scarps associated with faults capable of producing large earthquakes ($M_S \geq 7$) have been located and mapped.

- The Death Valley region, about 50 kilometers west of Yucca Mountain, has heretofore not been considered a major source of large earthquakes for assessing seismic risk at the site. This region may have a potential for producing large earthquakes, but more study is required to assess its earthquake capability.

- An earthquake within 15 km of the site of magnitude 6.0 could plausibly occur unassociated with a known fault and could possibly be a threat for exceeding 0.40 acceleration at the site.

- The relationship between earthquake magnitude and fault length and displacement for normal, oblique, and strike slip faults appears to be one of the most tenuous links for earthquake hazard assessment at Yucca Mountain.

- The historic seismic record at Yucca Mountain is too brief and incomplete to provide an accurate assessment of the frequency-magnitude relationship of the quality required to extrapolate future seismicity.

- Present estimates of peak ground acceleration at Yucca Mountain are based on empirical relationships that were not specifically derived for normal, oblique slip, or strike slip faults within an intraplate extensional regime. Thus, they should be re-evaluated for application to the Yucca Mountain region and assessed for standard error and uncertainties.

- Attenuation of ground motion appears to increase with depth and with frequency, but the site-specific attenuation properties at the Yucca Mountain are poorly understood. To ignore potential changes with depth appears to be conservative and is probably the best approach to apply at this time.

- Ground motion in compressional regimes such as Southern California may have little relevance for an extensional region like Yucca Mountain.

THE ISSUES: TECTONIC STABILITY AND GROUND MOTION

TECTONIC STABILITY

Before turning to actual seismic effects at Yucca Mountain such as ground motion due to an earthquake it is important to assess the likelihood of a major earthquake near the site. What is the tectonic stability of the region, in view of the conflicting indications cited by Rogers, Harmsen, and Carr (1983), for example? This question was discussed from a number of points of view, emphasized in the following six questions:

1. The United States Geological Survey (USGS) has recently completed in situ stress measurements in several boreholes at Yucca Mountain. What does the stress state at and near Yucca Mountain imply about future earthquakes near the site?

2. Rogers, Harmsen, and Carr (1983) cite an argument in favor of large magnitude earthquakes, based on the size of Great Basin scarps. What is the evidence for this as it applies to Yucca Mountain?

3. Weapons tests over the years at Nevada Test Site may provide an important test of the tectonic stability of the region. The tests have apparently induced slip on faults at distances not exceeding 15 km from the test site. Are these observations relevant in the present context?

4. The recent estimates of extension rate from geologic and seismic data for the Southern Breat Basin might be used to predict earthquake recurrence rate. What would this rate be for Yucca Mountain?

5. The existence of stable and unstable regions side-by-side seems quite in line with modern ideas about tectonics in the Western United States (Hill, 1982). Stable, more or less intact blocks are bounded by faults; the blocks are stronger that the faults, and so motion is

concentrated along the latter. By inference, earthquakes will be localized along block boundaries. In the present context, have the block boundaries been correctly located? In more concrete terms, are currently active fault zones well located in Yucca Mountain?

6. From an overall geologic standpoint, tectonic stability may be assessed from diverse observations of geomorphology, Holocene movement along faults, and the geologic settings of recent great earthquakes, etc. From such a point of view, which area in the Southern Great Basin has the greatest potential for a major earthquake?

1. In Situ Stres

Stress measurements in boreholes at Yucca Mountain (Stock et al. 1984) indicate that the region is characterized by a stress state in which both the least and greatest horizontal principal stresses are less than the vertical stress. The observed stress state corresponds to a normal faulting regime; the magnitude of the horizontal stresses indicate that frictional sliding on pre-existing fault surfaces could be expected to occur if the coefficient of friction along such faults were close to 0.6. According to Morrow and Byerlee (1984), the coefficient of static friction for repository tuff is about 0.85. In spite of the uncertainties in both of these values, it would have to be concluded that frictional failure on faults properly oriented for slip could be induced by small changes in regional applied stress or pore pressure. It will be important to verify this possibility with deeper stress measurements, in the future.

Observations by Smith and Bruhn (1984) and Das and Scholz (1982) suggest that large, M7+, earthquakes nucleate at depths of the maximum extent of seismicity. For the Basin and Range Province this appears to be at midcrustal values of approximately 15 km (Smith and Bruhn, 1984). Because of the limited depth of drilling, the state of stress at Yucca Mountain is known only to 1.5 km. It is not known if shallow stress measurements can readily be extrapolated to depths of 10 km or more. In other parts of the world, such as South Africa where measurements to nearly 4 km are available, no simple rules for extrapolation to greater depth are evident.

Accepting the above conclusions that failure on properly oriented faults could occur does it follow that a large earthquake is also imminent? This is certainly one possibility. Another possibility is that failure causes aseismic slip, that is, fault creep, or many small, non-damaging earthquakes. Current knowledge of tectonics of the Basin and Range is insufficient to choose among alternative interpretations of the on site stress data.

From the standpoint of seismic hazard, it is perhaps reassuring that in situ stress measurements in the Gulf Coast and in certain deep sedimentary basins within the U.S. (McGarr & Gay, 1978; Brace & Kolstedt, 1980) could also lead to a conclusion that frictional failure on properly oriented faults is imminent. However, current seismic activity in these regions is negligible.

In summary, in situ stress measurements suggest that frictional failure on properly oriented faults at Yucca Mountain might be induced by small changes in regional stress or pore pressure. Failure would not necessarily be accompanied by large earthquakes, but could induce aseismic slip or numerous small earthquakes.

2. Large Scarps

Association of large scarps with large earthquakes in the Great Basin has been suggested by Rogers, Harmsen, and Carr (1983), Bonilla and Buchanan (1970). The working group was not convinced that further studies will support this observation, particularly in light of recent information from the Wasatch Fault (Schwartz and Coppersmith, 1984; Swan, Schwartz, and Cluff, 1980) indicating large scarps have been produced by recurrent displacements along the same fault. An additional complication is that the nature of motion (dip-slip/strike-slip) on the fault will influence the likelihood that a large scarp is generated by a large earthquake.

3. Weapons Testing

Seismic signals resulting from cavity and chimney collapse and from relief of the stress cage surrounding the cavity are associated with underground nuclear explosions. The evidence indicates that the seismic waves generated by the explosion have rarely been effective in triggering incipient earthquakes beyond about 15 km.

Also, weapon tests do not provide a demonstration of tectonic stability for the region because (1) energy released by underground nuclear explosions may not be a good "trigger" for a tectonic earthquake, (2) it is difficult to differentiate a nearby simultaneous test and resulting induced seismicity, and (3) underground nuclear explosions do not exceed 1 to 2 km in depth; whereas large earthquakes probably nucleate 10 to 15 km deeper (Wallace, Helmberger, and Engen, 1983; Dicky, 1968; McKeown and Dickey, 1969; and Aki et al., 1969).

4. Extension Rates in the Basin Range

A potentially important indicator of seismic risk at Yucca Mountain is the regional extension rate across the souther Great Basin between the central Colorado Plateau and the southern Sierra Nevada Mountains. If the current extension rate for the province could be determined using geological information, seismic strain release data, and geodetic surveys, then an estimate of the strain across Yucca Mountain for the next 100,000 years could be made.

Long-term extension rates across the province at latitude 37°N are of the order of 1 cm/year (Wernicke and Burchfiel, 1982). Reconstruction of strike-slip fault systems across the province indicates at least 140 km of east-west separation between the Colorado Plateau and the southern Sierra Nevada (Wernicke and Burch fiel, 1982). Extension began approximately 15 million years ago, thus the extension rate is about 1 cm/year averaged across the province for the last fifteen million years. Seismic moment studies indicate release on an order of magnitude less, approximately 1 mm/year (Greensfelder, Kintzer, and Somerville, 1980; Smith, 1982; Smith, 1983). This may indicate that the current rate is considerably less than the 15 million year-average, but is more likely either a reflection of the inefficiency of seismicity in accommodating strain, an artifact of a lull in seismicity during the historical seismic record, or both. Local extension rates in highly extended areas in the Basin and Range can approach 2 cm/year every several million years (calculated from data in Anderson et al. (1972) and Miller, Gans, and Garing (1983)). A key geological observation is that the extension at any given time is localized confined to narrow belts rather than being uniformly distributed across the province as this appears to be the case today in the Death Valley region. In

addition to this, it is clear that some large blocks have remained strain-free during Basin and Range tectonism. The Yucca Mountain area is not within a strain-free block, and its structural style is akin to ancient examples which have experienced high extension rates. Thus, from a geological standpoint, a high rate across Yucca Mountain at the present time cannot be ruled out. It is unreasonable, however, to place bounds on the extension rate in the Yucca Mountain area via interpolation of province-wide strain rates because of the extreme inhomogeneity of strain accommodation apparent from the geologic record.

The above approach utilizes a 15 million-year average for extensional displacement. An alternate procedure is to consider the current extensional rates as determined by precise surveying.

Trilateration networks were established in Yucca Flat and Pahute Mesa in 1971 and were re-occupies in 1972, 1973, and 1983. The geodolite measurements were conducted by Savage and co-workers at the USGS in Menlo Park, California. The data from Yucca Flat (W. Prescott, pers. comm., 1984) consisting of measurements made over a block about 40 km in a N-S direction and 20 km E-W direction for the entire period can be fitted to a uniform strain field with the maximum principal strains being almost exactly N-S and E-W to within the error of the measurements. The N-S strain rate is -0.07×10^{-6} per year and the E-W strain rate is $+0.08 \times 10^{-6}$ per year. The same rates for the 15 million-year averages cited above are about $+0.07 \times 10^{-6}$ per year, a value which is remarkably close to the E-W strain of $+0.08 \times 10^{-6}$ per year.

For estimating recurrence times of major earthquakes, the most conservative assumption is that the strains accumulate entirely as elastic distortions and all the shear strain is released by displacement in a single strike-slip event on a N45W (or N45E) fault. As an example, the diagonals of a 20 km by 20 km block would accumulate a potential shear displacement of 1 meter in 400 years on a fault having the 28 km length of the block diagonal. In another calculation, if major earthquakes are accompanied by shear strain release of about

10^{-4}, it would require about 1,000 years to accumulate the necessary elastic strain. Thus, an earthquake of this size (1-meter strike-slip displacement, or 10^{-4} strain change) would occur in the measured area at NTS every 400 to 1000 years.

Strain rates estimated by cumulative moment tensors of historic seismicity for the Basin-Range (Smith, 1982 and unpublished data) suggest maximum displacement rates of approximately 2-4 mm/yr associated with the large M7+ earthquakes in the central Nevada seismic belt, then decreasing rapidly to rates of 1 mm/yr or less across the Yucca Mountain region. Greensfelder, Kinster, and Somerville (1980), also suggests relatively low strain rates of 2×10^{-8} per year for the Yucca Mountain region, increasing by an order of magnitude southward toward the Garlock fault to 10^{-7} per year.

5. Location of Potential Fault Zones

The NTS vicinity is one of the most scrutinized areas of the Basin and Range province and, although the surface mapping is very detailed, it does not preclude the existence of faults without surface expression. Many of the small earthquakes observed by the USGS seismic network cannot be associated with mapped faults. However, there is a high probability that all Quaternary-Holocene scarps associated with faults capable of producing large earthquakes are known.

When long zones in normal fault regimes, e.g., Madison, Wasatch, Borah Peak faults, have failed during large earthquakes, evidence to date suggests that they break along segments rather than along their entire length (Swan, Schwartz, and Cluff, 1980). The working group noted that analyses associated with the NNWSI Project have assumed failure over the entire fault length, whereas for other analyses, one-half the length has been used. Effort should be made to see if faults of concern can be segmented on the basis of end points, intersection of pre-existing structures (lateral termination), or other features. It is recommended that significant surface faults with Quaternary-Holocene scarps within about 30 km of the site be trenched to determine slip rate.

The potential of active faulting associated with seismicity can be examined using regional network data from southern Nevada and from detailed network studies in the immediate vicinity of the nuclear test site. In general, the seismicity of the Yucca Mountain region appears to be associated with the western end of a general E-W trending zone of seismicity that extends across southern Nevada at approximate latitude 37o. To the west of Yucca Mountain seismicity decreases westward toward the Furnace Creek-Death Valley region. Further west, increased activity is associated with the central Nevada and Walker Lane trend. A notable E-W gravity lineament of approximately 15 mgal (Eaton, et al 1978) is coincident with the E-W zone of seismicity; both trends are generally orthogonal to the N-S structural grain of Quaternary-Holocene Basin and Range topography. This raises a question regarding the source of the E-W seismic belt in terms of a deep crustal feature that is not known at this time.

The historical seismic record for the Great Basin is marked by a sparseness of data. This is due to the extremely low population density, which limits the number of observations in the case of pre-instrument intensity reports, and to the short length of time that regional networks have been in operation. It is imperative that the historical earthquake record is examined for completeness in order to ascertain the level of confidence for the assignment of statistical parameters such as the "a" and "b" values, which reflect the number of earthquakes of a given magnitude occuring through time.

The site-specific seismicity records for the Yucca Mountain region is somewhat limited in comparison to that inferred from the long-term seismic record at the neighboring NTS site. This problem may be partially addressed by making statistical analyses of the completeness of the seismic record, but, nonetheless, is a limitation for long term seismicity assessments.

Focal depth distribution of earthquakes can provide information regarding correlations between surface geology and faulting at depth. In general, to estimate focal depth requires that the distance from the epicenter to be no more than the a station focal depth in order to obtain an accurate measurement of the focal-depth parameter. In general, detailed station distributions in the immediate vicinity of Yucca Mountain have not been sufficient to assess

focal depth, and thus, it is difficult to correlate focal depths with surface faulting except perhaps for the deepest events.

Fault plane solutions for central and western portions of the Basin-Range including the Yucca Mountain site show varied distributions of pure normal, oblique normal, and strike slip solutions (Smith and Lindh, 1978; Ryall and Vanwormer, 1980; Rogers, Harmsen, and Carr 1981). While Quaternary faulting shows significant oblique lateral slip, large earthquake solutions show major components of E-W extension on normal faults. The smaller events show N-S to NW, to W extension on a variety of nodal planes. However, the consistent parameter of the general fault plane solution distribution for the southern Great Basin is the general northwest-southeast direction of the minimum stress in accordance with extension in that direction (Smith, 1978; Zoback and Zoback, 1980). Most large historic earthquakes in the western Great Basin that produced surface faulting show primary displacement in the down-dip direction. The significance of the strike slip solutions is not currently understood; they simply may be the accommodation of strain release along pre-existing fault planes that are not now favorably oriented for strike-slip faulting, or they may represent the potential of large lateral slip along such fault systems as the Death Valley-Furnace Creek zone.

Much of the intraplate deformation of the western United States has been attributed to "block" tectonics where coherent and stable volumes of the upper crust are bounded by or partially decoupled from adjacent blocks producing a mosaic of volumes bounded by active faults that accommodate regional displacement. Thus, at seismogenic depths, 0-15 km, the boundaries should be resolved by identifying seismicity patterns. Even small earthquakes, although not related to large strain release, may provide estimates of boundary zones. Given that maximum focal depths can be estimated for a region, the thickness of brittle seismogenic volumes can also be estimated.

6. Nearby Areas with High Potential for a Great Earthquake

The Death Valley region contains numerous long, Quaternary normal and strike-slip vaults associated with mountain-block uplifts 2000-3000 m high. The large

historical earthquakes in the Basin and Range Province (Dixie Valley-Fairview Peak, Owens Valley, Borah Peak) are associated with similar faults bounding large topographic escarpments. Although the Death Valley Furnace Creek Fault is considered to be relatively aseismic in the historical record, there is abundant evidence for major Quaternary displacements (Hunt and Mabey, 1966). It is highly significant that the Borah Peak event (Mag. 7.1) occurred in a region of little seismicity. In view of the youthfulness and large topographic escarpment associated with the Death Valley region, especially the Furnace Creek and Black Mountain fault zones, the likelihood of a number of large events (M7 or greater) on these faults within the next hundred thousand years should be considered high until proven otherwise.

GROUND MOTION

The tectonic stability of the region was reviewed in the previous section with a focus on its earthquake-generating characteristics. The review of ground motion in this section focuses on issues relevant to the establishment of ground motion criteria for the repository, utilizing information developed within the review of tectonic stability. Some of the same issues are re-examined in an effort to resolve differences in the estimates of fault characteristics, potential earthquake magnitudes, and credible levels of ground motion.

On the assumption that the largest credible earthquake for Yucca Mountain will follow procedures and definitions set forth in 10CFR100, Appendix A, the determination will provide the following:

- a map of tectonic provinces contained within a 200-mile radius around the site

- a catalog of historical seismicity within each tectonic province, any part of which is located within the 200-mile radius of the site

- an evaluation of the association of historical seismic events with capable faults, any part of which is situated within the 200-mile radius of the site.

As with tectonic stability, discussion of ground motion was focused on a number of questions as follows:

- What are the largest unassociated earthquakes to be expected within 15 km?
- What is the largest earthquake of any sort within 50 km?
- What are the recurrence intevals for large earthquakes?
- What is the attenuation of ground motion appropriate for Yucca Mountain?
- How will surface ground motion be attenuated at repository depth?

1. Unassociated Earthquakes

Yucca Mountain is interspersed with faults ranging outward from within a few hundreds of meters of the site. While there is no clear evidence to indicate that there has been movement along any of the faults within 10 km in the last 35,000 years, significant earthquakes cannot be ruled out with the information currently available. The experts concluded that an earthquake of magnitude approximately 6 could plausibly occur at depth in this area without significant surface manifestations.

As a result of this evaluation, the issue of earthquakes unassociated with known seismogenic faults was reviewed. To assess the importance of unassociated earthquakes, an extremely rough estimate was made for the return period of

a magnitude 6 earthquake within 15 km of the repository site. Convenient assumptions were made in arriving at the estimate, namely:

- The Basin Range structure was assumed to be undergoing spatially uniform extension at the rate of 0.2 mm/yr per 1° x 1° area, which yields about .02 mm/yr within 15 km of the site. Smith (1982) provided estimates of extension rates that varied from undiscernable values to as high as approximately 4 mm/yr per 1° x 1° area along the active central Nevada seismic zone.

- All extension is assumed to be manifested by uniformly distributed magnitude 6 earthquakes. Furthermore, each earthquake is assumed to produce 150 mm (Bonilla, 1982) of offset over a length of 11 km (Mark and Bonilla, 1977).

With these assumptions, the recurrence interval (I) for magnitude 6 earthquakes within 15 km is approximately,

$$I = \frac{(150 \text{ mm/earthquake}) \times (3 \text{ earthquakes for release within 15 km})}{.02 \text{ mm/yr within 15 km}}$$

$$= 2500 \text{ years}$$

If 90 percent of the magnitude 6 earthquakes were associated with identifiable faults, the recurrence interval for unassociated earthquakes would increase by a factor of ten, or

$$I = 25{,}000 \text{ years}$$

for unassociated magnitude 6 earthquakes within about 15 km of the site. Note that these recurrence intervals for unassociated earthquakes differ from those calculated on page 6-7 for associated earthquakes.

Several relevant factors are not included in this estimate for recurrence interval. Nevertheless, the potential for earthquakes unassociated with identified seismogenic faults appears to be substantial and should be considered in the development of ground-motion criteria for the site. The

working group recommended three approaches for dealing with the issue of unassociated earthquakes.

1. The historic seismicity within the Basin Range should be carefully reviewed for unassociated earthquakes of magnitude greater than 5.5. The numbers and magnitudes of earthquakes not associated with faults within the Basin Range could then be used to estimate the potential for unassociated earthquakes in the near-site region by scaling the results to the site area. Completeness of this seismic record is critical for these studies.

2. Extensive field investigations should be conducted within about 10 km of the site to further assess the potential for significant local earthquakes. The investigations should identify any throughgoing fault-related features and characterize the local earthquake history from geologic imprints using a combination of gravity and magnetic surveys, radar soundings, fault trenching, and age dating.

3. Ground motion criteria should be developed over a range that accommodates reasonably plausible earthquakes, including local earthquakes not associated with any identified seismogenic fault. Although, the seismogenic characteristics indicate that ground accelerations in excess of 0.4g are not likely during preclosure, more severe levels of ground motion cannot be ruled out. However, McGarr (1984) regards 0.5g as the maximum surface acceleration likely in an extensional regime such as Yucca Mountain.

2. Largest Credible Earthquake Within 50 km

Knowledge of existing faults is based primarily on surface expression. Large scarps have been associated with both large earthquakes and as cumulative displacements. Unless there is a clear surface manifestation of a fault terminus, the precise subsurface length will remain uncertain.

Relations between fault length and the largest credible magnitude earthquake (Bonilla and Buchanan, 1970; and Mark and Bonilla, 1977) result from data with a great variability in the earthquake fault length that is associated with a given magnitude, even when normal-slip, normal oblique-slip, and strike-slip faults are treated separately. For example, a predicted earthquake magnitude for a 17 km fault is 6.8 $\pm$ 0.8 based on standard errors of the estimates. Much of this spread is due to differences in the true earthquake fault length and surface expression. (The working group did not have access to a recent report by Bonilla or recent tabulations of earthquake fault length for varying magnitudes by Slemmons). The relation between earthquake fault length and magnitude appears to be one of the most tenuous links in hazard assessment.

What is needed is a tabulation of the largest historical magnitude earthquake for faults of various types and lengths with focus on normal, oblique, and strike-slip events that occur in intraplate extensional regimes. An earthquake of magnitude 6.8 is hardly credible on a local fault that is only 17 km long, provided the fault does indeed terminate at 17 km. Because of uncertainties in the actual extent of the seismogenic faults at depth, magnitudes from 6.6 to 6.8 have been estimated for faults within about 30 km of the site.

The working group has identified two courses of action:

- A concerted effort should be made to identify the fault-length relation most applicable for estimating the largest credible magnitude on local seismogenic faulst and this relationship should be applied to re-evaluate current estimates.

- Field work should be initiated to establish constraints on the fault length that could plausibly fracture in a single earthquake. Trenching and age-dating of faults close to Yucca Mountain (Bow Ridge, Paintbrush Canyon, Solitario Canyon, etc.) associated with radar sounding should be accomplished by a team of independent observers. This effort should be extended to several locations along each capable fault longer than a few thousand feet.

Information currently available does not permit a determination of whether the close faults or more-distant faults (e.g., Furnace Creek) associated with larger magnitude events constitute the more likely hazard. Empirical relationships between peak ground acceleration and earthquake magnitude for varying distances indicate that a magnitude 6.5 earthquake at a distance of 15 km will generate higher accelerations than a magnitude 7.5 at 50 km or greater. Similarly, a magnitude 6 earthquake at distances less than 15 km could produce even higher accelerations. A moderate to large earthquake at distances in excess of 30 km probably represents the most likely scenario. The largest credible accelerations would likely result from a moderate earthquake at a distance less than 20 km.

3. Future Seismicity

Average estimates for the rate and magnitude distribution of future earthquakes in the Basin Range can be extrapolated from the historic and geologic record. The historic record is too brief to represent the potential for earthquakes on individual faults or to predict seismicity in a region the size of Yucca Mountain. The historical record of the entire Basin and Range province is needed to approach valid sampling statistics, and the corollary follows that extrapolations of future earthquakes during preclosure (about 90 years) can only be applied with confidence over a large region the size of the Basin and Range.

To demonstrate a reliable basis for extrapolating the rate and magnitude distribution of future earthquakes, alternate procedures for characterizing previous earthquake activity should be examined, and consistency should be established. Specifically, the working group recommends the following studies to assess future seismicity.

1. Develop Quaternary Holocene return rates based on "a" and "b" values derived from historical magnitude and intensity data. Rogers, Perkins, and McKeown (1977) developed numbers for earthquakes within 400 km, which included large earthquakes on the San Andreas fault.

This work should be revised to include only earthquakes from the Basin and Range, not including San Andreas earthquakes. Seismic activity based on historical data should include a measure of the uncertainty.

2. Develop slip rates by dating fault offsets within the Basin and Range. Spatial variations for the rate of deformation should be estimated to identify the relative stability or instability of Yucca Mountain. Estimates of the uncertainty should also be developed. Analyses of the above techniques should be made to determine both sensitivity and resolution of the above proposed solutions using the extreme ranges of significant parameters.

3. Estimate the regional deformations using geodetic control and provide estimates of the uncertainties.

4. Compare the activity rates from historical seismicity, fault offsets, and geodetic surveys to test consistency. Also, compare the results with estimates of the Basin and Range activity developed in other studies. Use these results to develop a range for the return period of local earthquakes of varying magnitudes and site-specific levels of ground motion.

4. Attenuation of Ground Motion

The expected peak acceleration specified in the draft Environmental Assessemnt for the Yucca Mountain site (1985) was based on the seismic hazard analysis developed by Rogers, Perkins, and McKeown (1977). This analysis utilized a ground-motion attenuation relationship developed by Schnabel and Seed (1973). Although this relationship was a reasonable one to use prior to 1980, other attenuation curves have been developed as a result of more recent data. Furthermore, the analysis does not include a specified standard error, preventing estimates of uncertainty.

It is recommended that the expected peak acceleration at Yucca Mountain be recalculated using one of the more recent attenuation relationships, e.g., Campbell (1981), Joyner, and Boore (1981), along with a new reference for magnitude/fault relationships (Bonilla, Mark, and Lienkoemper, 1984). It should be noted that published attenuation functions are dominated by data from Southern California. Thus, the use of these empirical functions could contain biases resulting from differences in the properties of the earthquake sources and wave paths between Southern California and the tectonic subprovince containing Yucca Mountain. The possibility of biases should be investigated using ground motion recordings of earthquakes in normal fault environments, incorporating, where possible, measurements from extensional zones of the western United States and others. Also, site-specific conditions (rock, alluvium, etc.) should be considered in the development of site-specific ground motion criteria.

McGarr (1984) has recently shown that peak acceleration is strongly dependent on stress state. In particular, peak acceleration in the compressional regime such as Southern California is nearly three times greater than in an extensional regime such as Nevada for earthquakes of comparable size and focal depth. Use of acceleration relationships from events in California may be very misleading for hazard assessment at Yucca Mountain.

Finally, it is further recommended that the design peak ground acceleration include a provision for the uncertainties in the estimate of peak ground accelerations from a specified earthquake magnitude at a specified distance. Mean estimates plus one standard deviation would be appropriate for characterizing these uncertainties.

5. Attenuation of Ground Motion with Depth

Ground motions resulting from both earthquakes and underground nuclear explosions (UNEs) are important in the assessment of the repository facilities located at a depth of 350 m. While motions at depth have been and continue to be recorded at NTS for UNE motions, few subsurface recordings of earthquakes have been made.

Japanese data on earthquakes, reported by Okamoto (1973), Kanai et al. (1951, 1953, 1954, 1966), and Iwasaki, Wakabayashi, and Tatsuoka (1977) indicated that motions in general decrease with depth, although little or no reduction was observed at isolated sites for some earthquakes. A velocity attenuation curve developed by Kanai for a depth of 100 m in rock, predicts velocities less than predicted by using the Schnabel and Seed (1973) curves for surface rock velocities at the same focal distance (Pratt, Hustrulid, and Stephenson, 1978). Owen and Scholl (1980) have observed that the amount of depth reduction is dependent upon site geology, wave form, and motion duration. The latter two parameters are, in turn, dependent upon earthquake magnitude, source type, epicentral distances, and wave path geology.

Given the uncertainties in modeling depth dependence and the sparsity of ground motion measurements at depth for earthquakes, it is not feasible at this time to provide precise predictions of the motions at depth from values at the surface. Current evidence indicates that acceleration at the repository depth will be significantly less than at the surface and that velocity will also attenuate with depth, but less significantly than for acceleration. Below the free surface of the earth, displacement will probably not be significantly reduced, but the data base is extremely sparse.

Without better predictors, it is reasonably conservative to ignore potential reduction with depth for the purpose of design of tunnel and underground chambers. Data summarized by Dowding (1978) indicate that, in general, underground structures are less likely to be damaged than surface structures at the same epicentral distance.

REFERENCES

Aki, K., P. Reasenbert, T. De Fazio, and Y. B. Tsai, 1969. Near-field and far-field seismic evidences for triggering of an earthquake by the BENHAM Explosion, Bulletin of the Seismological Society of America, Vol. 59, No. 6, pp. 2197-2207.

Anderson, R. E., C. R. Longwell, R. L. Armstrong, and R. S. Marvin, 1972. Significance of K-Ar of tertiary rock from Lake Mead region, Nevada, Arizona, Geological Society of American Bulletin, Vol. 83, pp. 273-288.

Bonilla, M. G., R. K. Mark, and J. J. Lienkoemper, 1984. Statistical relations among earthquake magnitude, surface rupture length and surface fault displacement, USGS-OFR-84-256, Open-File Report, U.S. Geological Survey, (in press).

Bonilla, M. G. and J. M. Buchanan, 1970. Interim report on worldwide historic surface faulting, USGS-OFR Open-File Report, U.S. Geological Survey.

Brace, W. R. and D. Kolstedt, 1980. Limits on lithospheric stress imposed by laboratory experiments, Journal of Geophysical Research, Vol. 85, pp. 6248-6252.

Campbell, K. W., 1980. Seismic hazard analysis for the NTS spent reactor fuel test site, UCRL-15620, Lawrence Livermore National Laboratory, Livermore, Calif.

Das, S., and C. H. Scholtz, 1983. Why large earthquakes do not nucleate at shallow crustal depths, Nature, Vol. 305, pp. 621-623.

Dickey, D. D., 1968. Fault displacement as a result of underground nuclear explosions, in Nevada Test site, Edwin B. Eckel (ed.), Geological Society of America Memoir 110, pp. 219-232.

Dowding, C. H., 1978. Seismic stability of underground openings, in Proceedings of the First International Symposium on Storage in Excavated Rock Caverns, Rockstore 77, Stockholm, Sweden, Vol 2, pp. 231-238.

Eaton, G. P., R. R. Wahl, H. J. Prostka, D. R. Mabey, and M. O. Kleinkopf, 1978. Regional gravity and tectonic patters: Their relation to late Cenozoic epeirogeny and lateral spreading in the western Cordillera, Geological Society of America Memoir 152, pp. 51-91.

Greensfelder, R. W., F. C. Kinster, and M. R. Somerville, 1980. The seismotectonic regionalization of the Great Basin, and comparison of moment rates computed from seismic strain and historic seismicity, Summary, Geological Society of America Bulletin, Vol. 81, pp. 518-523.

Greensfelder, R. W., F. C. Kintzer, and M. R. Somerville, 1980. Probable earthquake ground motion as related to structural response in Las Vegas, NV, JAB-00099-120, URS/BLUME.

Hill, D. P., 1982. Contemporary block tectonics: California and Nevada, Journal of Geophysical Research, Vol. 87, pp. 5433-5450.

Hunt, C. B. and D. R. Mabey, 1966. Stratigraphy and structure, Death Valley, CA. U.S. Geological Survey Professional Paper 494A.

Iwasaki, T., S. Wakabayashi, and F. Tatsuoka, 1977. Characteristics of underground seismic motions at four sites around Tokyo Bay, wind and seismic effects, H. S. Lew (ed.), U.S. Department of Commerce, Washington, D.C.

Joyner, W. B. and D. M. Boore, 1981. Peak horizontal acceleration and velocity from strong motion records, including records from the 1979 Imperial Valley, California earthquake, Bulletin of the Seismological Society of America, Vol: 71, pp. 2011-2038.

Kanai, K. and T. Tanaka, 1951. Observations of the earthquake-motion at the different depths of the earth, I, Bulletin of the Earthquake Research Institute, Vol. 29, pp. 107-113.

Kanai, K., K. Osada, and S. Yoshizawa, 1953. Observations study of earthquake motion in the depth of the ground, IV (Relation between the amplitude at ground surface and the period), Bulleting of the Earthquake Research Institute, Vol. 31, pp. 228-234.

Kanai, K., T. Tanaka, S. Yoshizawa, T. Morishita, K. Osada, and T. Suzuki, 1966. Comparative studies of earthquake motions on the ground and underground, II, Bulletin of the Earthquake Research Institute, Vol. 44, pp. 609-643.

Mark, R. K. and M. G. Bonilla, 1977. Regression analysis of earthquake magnitude and surface fault length using the 1970 data of Bonilla and Buchanan, USGS-OFR-77-614, Open-File Report, U.S. Geological Survey.

McGarr, A., 1984. Scaling of groundmotion parameters, state of stress and focal depth, Journal of Geophysical Research, (in press).

McGarr, A. and N. C. Gay, 1978. State of stress in the earth's crust, Ann. Rev. Earth and Planetary Science, Vol. 6, pp. 405-436.

McKeown, F. A., and D. D. Dickey, 1969. Fault displacements and motion related to nuclear explosions, Bulletin of the Seismological Society of America, Vol. 59, No. 6, pp. 2253-2271.

Miller, E. L., T. B. Gans, and J. Garing, 1983. The Snake Range decollement; an exhumed mid-tertiary ductile brittle transition, Tectonics, Vol. 2, pp. 239-263.

Morrow, C. and J. Byerlee, 1984. Frictional sliding and fracture behavior of Nevada Test Site tuff in 25th Symposium on Rock Mechanics, Evanston, Ill.

Okamoto, S., 1973. Introduction of Earthquake Engineering, John Wiley & Sons, New York, New York.

Owen, G. N., and R. E. Scholl, 1980. Earthquake engineering, large underground structures, FHWA-RD-80/195, prepared for Federal Highway Administration and National Science Foundation by URS/John A. Blume and Assoc., Engineers, Washington, D.C.

Pratt, H. R., W. A. Hustrulid, and D. E. Stephenson, 1978. Earthquake damage to underground facilities, Savannah River Laboratory Report, DP-1513, pp. 20-25.

Rogers, A. M., D. M. Perkins, and F. A. McKeown, 1977. A preliminary assessment of the seismic hazard of the Nevada Test Site Region, Bulletin of the Seismological Society of America, Vol. 67, No. 6, pp. 1587-1606.

Rogers, A. M., Harmsen, W. j. Carr, 1981. Southern areal basin seismological data report for 1980, USGS-OFR-81-1086, Open-File Report, U.S. Geological Survey.

Rogers, A. M., Harmsen, W. J. Carr, 1983. Southern areal basin seismological data report for 1981, USGS-OFR-83-669, Open-File Report, U.S. Geological Survey.

Ryall, A. S. and J. D. Vanwormer, 1980. Estimation of maximum magnitude or recommend seismic zone changes in the Western Great Basin, Bulletin of the Seismological Society of America, Vol. 70, pp. 1573-1581.

Schnabel, D. B. and Seed, M. B., 1973. Accelerations in Rock for Earthquakes in the Western United States, Bulletin of the Seismological Society of America, Vol. 63, pp. 501-516.

Schwartz, D. P., and K. J. Coppersmith, 1984. Fault behavior & characteristic earthquakes: Examples from the Wasatch and San Andreas fault zones, Journal of Geophysical Research, Vol. 89, No. B7.

Smith, R. B., 1978. Seismicity, crustal structure, and intraplate tectonics of the interior of the Western Cordillera, Geological Society of America Memoir 152, pp. 111-144.

Smith, R. B. and A. Lindh, 1978. A compilation of fault plane solutions of the Western United States, in Cenozoic tectonics and regional geophysics of the Western Cordillera, Geological Society of America Memoir 152, pp. 107-110.

Smith, R. B., 1982. Intraplate seismo-tectonics and mechanisms of extension in the Western United States, Abstract, American Geophysical Union Chapman Conference on Fault Behavior and the Earthquake Generation Process, Alta, Utah, October, 1982.

Smith, R. B. and R. L. Bruhn, 1984. Intraplate extensional tectonics of the Eastern Basin-Range: Inferences on structural style from seismic reflection data, regional tectonics, and thermalmechanical models of brittle-ductile deformation, Journal of Geophysical Research, Vol. 89, No. B7, pp. 5733-5762.

Stock, J. M., J. H. Healy, S. H. Hickman, and M. D. Zoback, 1984. Hydraulic fracturing stress measurements at Yucca Mountain, Nevada and relationship to the regional stress field, Journal of Geophysical Research (in press).

Swan, F. H., III, D. P. Schwartz, and L. S. Cluff, 1980. Recurrence of moderate-to-large magnitude earthquakes produced by surface faulting on the Wasatch fault zone, Bulletin of the Seismological Society of America, Vol. 70, pp. 1431-1462.

Vanwormer, J. D. and A. S. Ryall, 1980. Sierra Nevada-Great Basin boundary zone: Earthquake hazard related to structure, active tectonic processes, and anomalous patterns of earthquake occurence, Bulletin of the Seismological Society of America, Vol. 70, pp. 1557-1572.

Wallace, T. C., D. V. Helmberger, and G. R. Engen, 1983. Evidence of tectonic release from underground nuclear explosions in long-period P Waves, Bulletin of the Seismological Society of America, Vol. 73, pp. 593-613.

Wernicke, B. and B. C. Burchfiel, 1982. Modes of extensional tectonics, Journal of Geophysical Research, Vol. 4, pp. 9331-9340.

Zoback, M. L. and M. D. Zoback, 1980. State of stress in the conterminous United States, Journal of Geophysical Research, Vol. 85, pp. 6113-6156.

Appendix 1

PARTICIPANTS

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A brief background description of the members of the group of experts is given below.

William F. Brace - Professor and Chairman, Department of Earth and Planetary Sciences, Massachusetts Institute of Technology at Cambridge, MA; member of the National Academy of Sciences; Fellow of American Academy of Arts and Sciences; President of Tectonophysics Section of the American Geophysical Union (1963-1969). Dr. Brace is an internationally known expert in the area of tectonophysics and the physical and mechanical properties of earth materials. He is Associate Editory of the Rock Mechanics Journal; Associate Editor Tectonophysics, Geological Society of America, and International Journal of Rock Mechanics and Mining Science. Dr. Brace is a leading member of the academic community in the role of in situ stresses as they relate to seismicity and tectonics. Ph.D., geology, Massachusetts Institute of Technology, 1953.

Gerald A. Frazier - Senior Scientist, Science Applications International Corporation, La Jolla, California. Dr. Frazier is an expert in the assessment of earthquake and explosion induced ground motions. He has led several studies for evaluating potential earthquake hazards to nuclear power plants and has provided a lead role in the licensing pursuits for utility companies. He has developed technology for numerically simulating explosion induced ground motions for both near and far-field response. He is the lead research seismologist at the DARPA Center for Seismic Studies, Washington, D.C. Ph.D., civil engineering, Montana State University, 1969.

Howard R. Pratt - Corporate Vice President, Science Applications International Corporation, La Jolla, California. Dr. Pratt manages the Earth Sciences Operation which has six divisions specializing in geology and geophysics, instrumentation engineering and data processing, civil engineering, geotechnical engineering, geomechanics and solid mechanics. Programs cover a wide range of calculational and experimental support efforts in areas such as nuclear weapons effects, nuclear waste isolation, nuclear power plant design, civil works projects, and energy resource exploration. He is a recognized expert in rock mechanics and engineering geology and has conducted active research in large-scale field experiments to evaluate material properties in situ, ground motions associated with earthquakes and explosive sources. Adjunct Professor University of Utah (1969 to present). Ph.D., geology, University of Rochester, 1966.

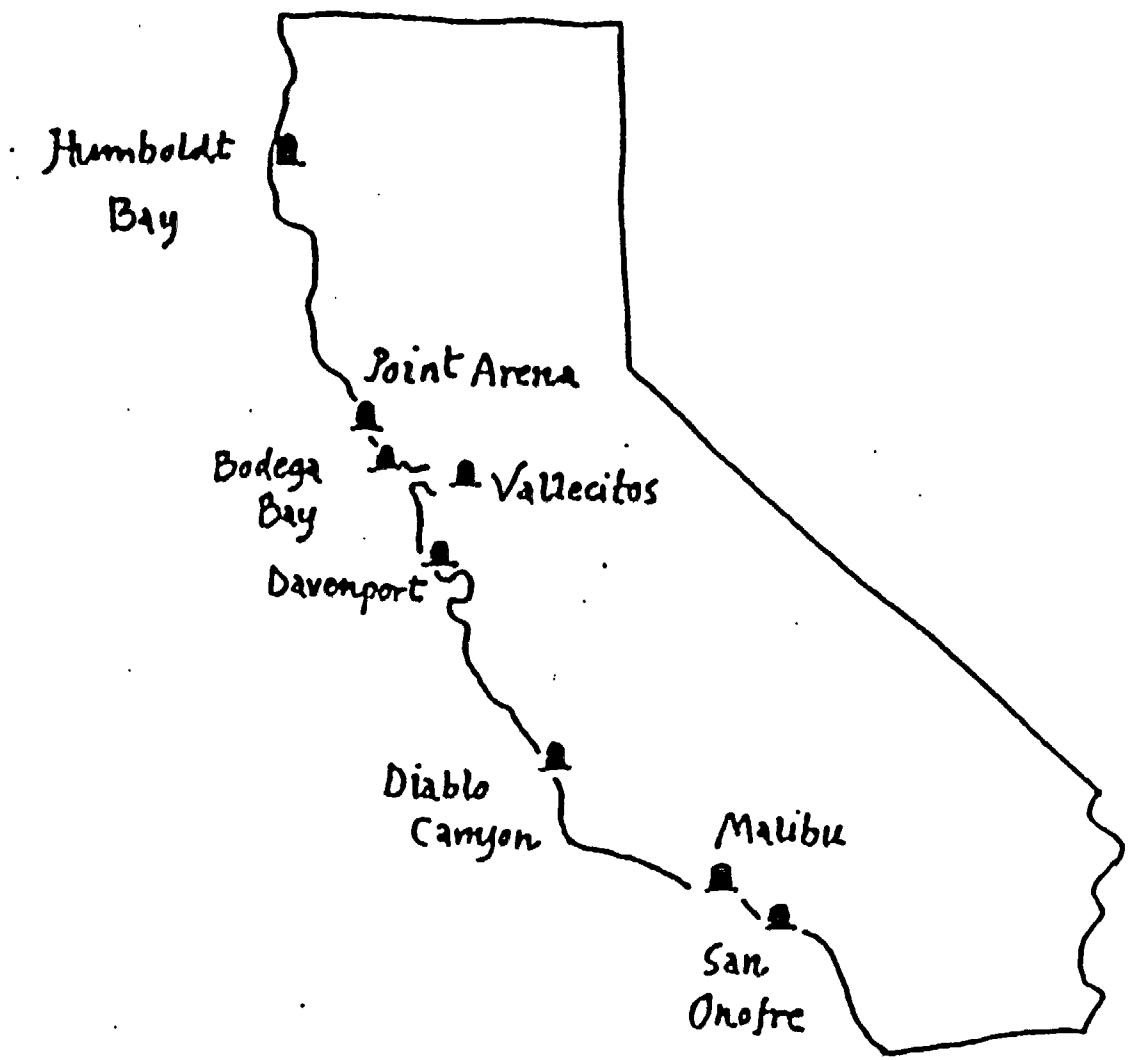
C. Barry Raleigh - Director Lamont-Doherty Geological Observatory of Columbia University and Professor, Department of Geological Sciences, Columbia University, New York, New York. Dr. Raleigh is an internationally known expert in the area of tectonophysics, earthquake prediction, and experimental rock mechanics. Author of over eight papers in these technical areas, including many on in situ stress measurements. Fellow, American Geophysical Union and Geological Society of America, President, Tectonics section, American Geophysical Union. Former Coordinator of the Earthquake Prediction Program, U.S. Geological Survey and Chief of the branch of Earthquake Tectonics, Office of Earthquake Studies, U.S. Geological Survey. PhD., geology, geophysics, University of California at Los Angeles, 1963.

Robert B. Smith - Profession Geophysics, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah and Director, University of Utah, Seismograph Stations. Dr. Smith's primary research areas are in theory and method in seismic reflection and refraction; earthquake seismology, and tectonophysics. His research interests are earthquake investigations of intraplate earthquakes with emphasis on intermountain seismic belt; seismological investigations of crustal structure of the Western United States; and mechanical properties of mountain building uplift and magma placement from seismological data. Associate editor of the Journal of Geophysical Research, Member of the National Academy of Science Committee on Seismology, Ph.D., geophysics, University of Utah, 1967.

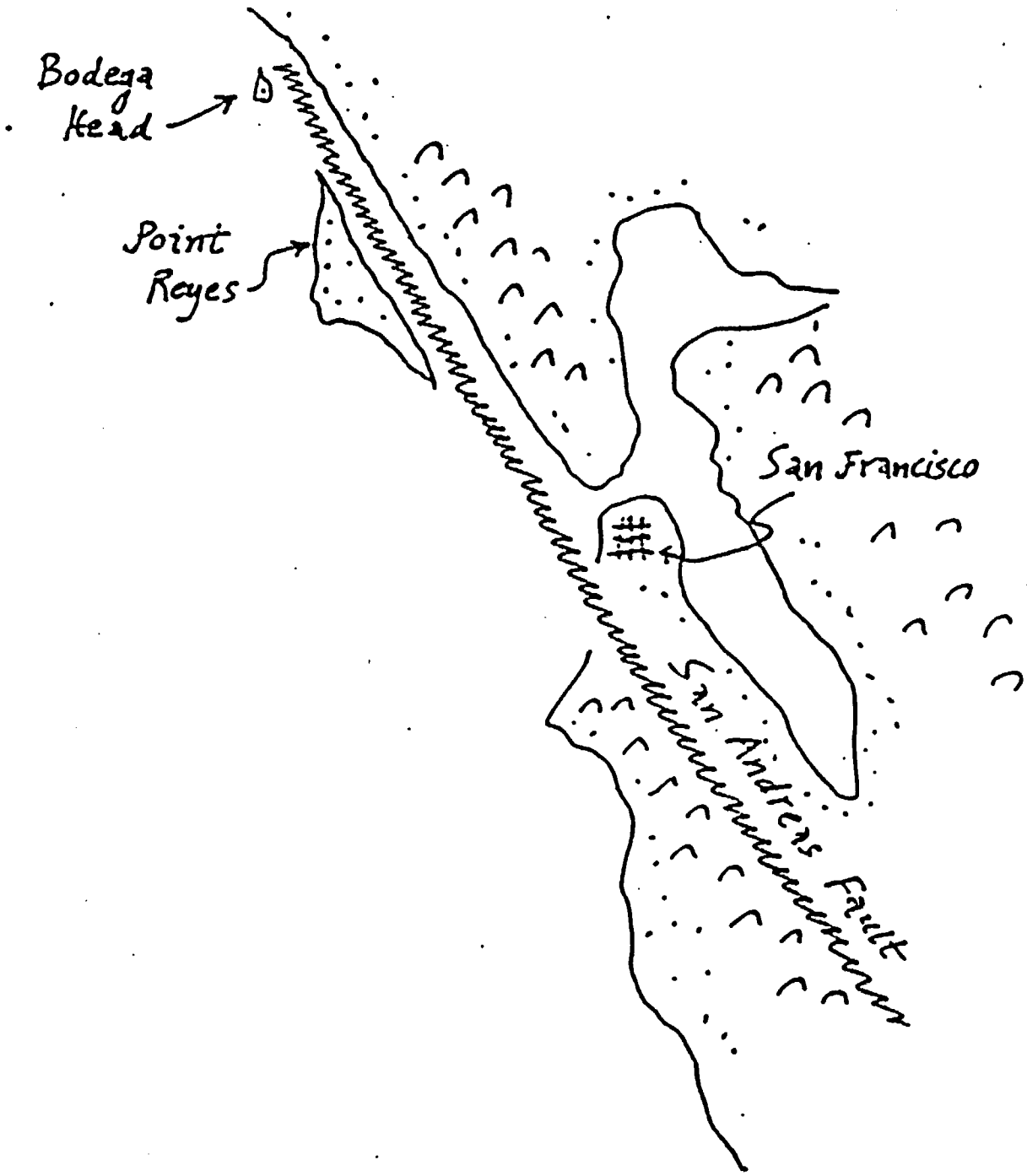
Brian P. Wernicke - Assistant Professor, Department of Geological Sciences, Harvard University, Cambridge, Massachusetts. Dr. Wernicke is an expert in the structural geology of the Basin and Range Province in the United States. He is nationally known for his work in extension tectonics of the Basin and Range Province of Nevada, Utah and California and the author of many papers on that subject. Consulting geologist to oil companies on the structure and tectonics of Western United States. Ph.D., geology, Massachusetts Institute of Technology, 1982.

GEOLOGY IN LICENSING

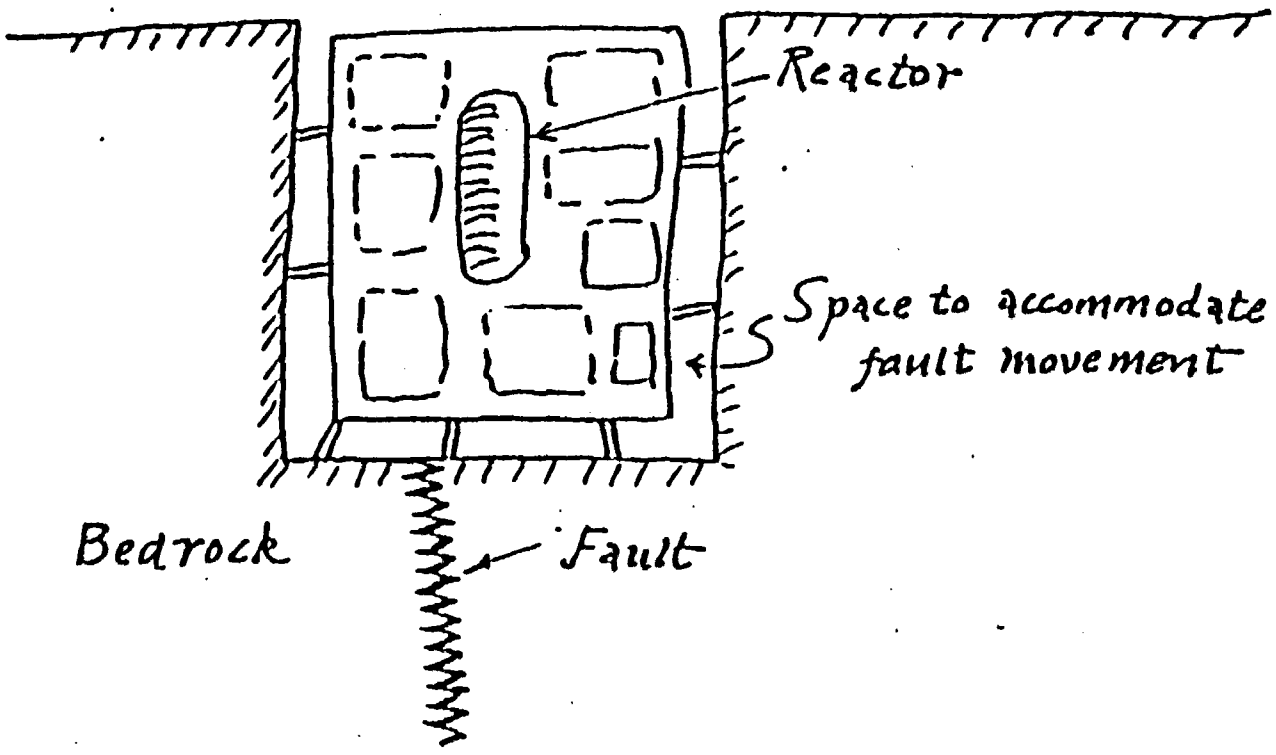
NUCLEAR FACILITIES



Actual and proposed California nuclear power plant sites



Bodega Head location map



PG and E's proposed fault-proof design at Bodega Head

Few places on the earth are exposed to more certain earthquake risk than are those along the San Andreas fault in northern and central California. The case arguing the safety of the Bodega Head site rests largely on the confidence that "granite" is a good foundation material and that it minimizes ground shaking due to earthquakes and on the judgment, supported but not proved by geologic investigations of Bodega Head, that no faulting has occurred there during the past several thousand years. The case against the site stresses seismology's lack of detailed information on events and conditions in the epicentral tract of a major earthquake. Because we cannot prove that the worst situation will not prevail at the site, we must recognize that it might. Acceptance of Bodega Head as a safe reactor site will establish a precedent that will make it exceedingly difficult to reject any proposed future site on the grounds of extreme earthquake risk.

It is hoped that this review will illustrate the tenuous nature of some of the scientific judgments that must be made, these judgments then serving as the body of "fact" on which the engineering design of the plant will be based. The primary difficulty is that the seismologist is called upon to make judgments that require large extrapolations beyond his personal professional experiences and even beyond those of the science he serves. When such seismological judgments are shorn of qualifications and condensed to a convenient statement for engineering guidance, they take on an unwarranted ring of certainty that belies their shaky foundations. The thread of responsibility is broken at this step, the seismologist believing that he has handed it to the engineeer, who reasonably feels that it remains with the seismologist.

The Geological Survey concluded that "...even given the most careful execution of the exploration program as outlined and the most favorable return of data for efforts expended, there would remain certain areas of inadequate coverage and certain residual indeterminacies which would preclude final evaluation of the site with the degree of conservative assurance normally required for such applications." ⚒

10 CFR 100

"REACTOR SITE CRITERIA"

APPENDIX A

"SEISMIC AND GEOLOGIC SITING CRITERIA FOR NUCLEAR POWER PLANTS"

The history of AEC/NRC criteria for siting nuclear power plants on or near faults follows:

February 1956
"No facility should be located closer than one quarter to one half a mile from the surface location of a known active earthquake fault."

May 1959
"The earthquake history of the area in which the reactor is to be located is important . . . a site should not be located on a fault."

April 1962
One quarter to one half a mile exclusion changed to one quarter mile.

1966–1969
Development of siting criteria eventually incorporated in 10 CFR 100, Appendix A.

Appendix A published for public comment.

November 1973
Appendix A adopted. Defines "capable fault as having moved once in 35,000 years or recurrently in 500,000 years; or being associated with 'macroseismicity'; or associated with other capable fault."

April 1979
Publication of SECY-79-100 Information Report, critiquing Appendix A.

NUCLEAR FAULTING - DISPLACEMENT

BODEGA HEAD
MALIBU
DAVENPORT
POINT ARENA
NORTH ANNA
HUMBOLDT BAY
VALLECITOS
SATSOP

NUCLEAR FAULTING - VIBRATORY GROUND MOTION

DIABLO CANYON
INDIAN POINT
SAN ONOFRE 2/3
TROJAN
HANFORD
SKAGIT
PEBBLE SPRINGS
CENTRAL U.S. PLANTS
EASTERN U.S. PLANTS

APPLICANTS

AEC/NRC

ACRS

USGS

USCGS

INTERVENORS

OBSERVATIONS

1. GEOLOGY IN ADJUDICATED PROCEEDINGS

2. PRECISE (FACTS) VS IMPRECISE (JUDGEMENT)

3. 4.5 BILLION YEAR HINDSIGHT VS 100 - 10,000 YEAR FORESIGHT

4. NEED FOR PROBLEM DEFINITION BEFORE ATTEMPTING SOLUTION

5. NEED TO FOCUS ATTENTION ON SOLUTION TO PROBLEM DEFINED

6. NEED FOR REACHING A DECISION WITHOUT ALL THE "FACTS"

Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114-4100

MAY 31 1985

W. J. Purcell, Director, Office of Geologic Repositories, DOE/HQ (RW-20), FORSTL

NNWSI PROJECT WEEKLY HIGHLIGHTS FOR WEEK ENDING MAY 23, 1985

I. Issues Requiring Involvement of HQ or Other Projects

A. New Issues:

None to report.

B. Previously Reported Issues:

	Issue	Status	First Report Date
1.	Regarding March 18 letter to Purcell requesting support to resolve OCRWM position on transportation, a meeting or plan is required to clarify issues and document OCRWM policy positions.	Open	3/20/85
2.	Regarding March 19 letter to E. S. Burton - EA Briefings and Hearings - requested copy of documents generated as a result of "Roles and Responsibilities at Briefings" memo.	Open - Per ISGG Meeting 5/9-10, should be available 6/15.	3/14/85

II. Major Internal Concerns

None to report.

III. Significant Accomplishments (SA)/Information Items (II)

SA

None to report.

II

On May 21, WMPO gave a briefing in Las Vegas on the NNWSI Project to Reggie Ortiz, a protocol officer at the Albuquerque field office. She will be on detail to Ben Rusche during the summer.

Max Blanchard presented the waste management portion of the community monitoring program to a Caliente Town Hall Meeting on May 22.

Vern Witherill presented the waste management portion of the community monitoring program to the citizens of Pioche.

At HQ's request, Jean Younker gave a briefing to Bill Purcell and the OGR staff on the NNWSI Project Issues Hierarchy on May 17. The purpose was to clarify the role of the Issues Hierarchy as a basis for site characterization and regulatory compliance.

On May 23, Max Blanchard and Mike Voegele will meet with Bob Loux from the State of Nevada to review the approved SCP Annotated Table of Contents per the State's request.

IV. Upcoming Events

1. Coordination Group Meetings

- o Tuesday-Thursday, June 25-27: Waste Package Coordination Group Meeting, Denver.

2. HQ Meetings

- o Monday-Tuesday, June 3-4: DOE Inspector General visit.
- o Wednesday-Thursday, June 5-6: OGR Budget Meeting, Washington, D.C.

3. Internal Project and DOE/NV Meetings

- o Wednesday-Thursday, May 29-30: PM-TPO Meeting, Las Vegas.
- o Monday, June 3: SCP Management Group Meeting, Las Vegas.
- o Tuesday, June 4: Don Vieth Meeting with USGS, Reston.
- o Wednesday-Thursday, June 12-13: ESTPC Meeting, Los Alamos.
- o Monday, June 17: SCP Management Group Meeting, Las Vegas.
- o Wednesday-Thursday, June 26-27: PM-TPO Meeting, Las Vegas.

4. State and Public Interaction

   - o Thursday, May 30: Don Vieth talk to Soroptimists, Las Vegas.
   - o Thursday-Wednesday, June 13-19: USNCTT, New York (Don Vieth).
   - o Wednesday, June 26: Pine County Commissioners/Ely Town Meeting (Tentative).

5. NRC Interaction

   - o Tuesday-Wednesday, June 23-24: NRC/DOE Waste Package Meeting.

Donald L. Vieth, Director
Waste Management Project Office

WMPO:DLV-1030

cc:
J. W. Bennett, DOE/HQ (RW-22), FORSTL
R. J. Blaney, DOE/HQ (RW-22), FORSTL
C. R. Cooley, DOE/HQ (RW-24), FORSTL
M. W. Frei, DOE/HQ (RW-23), FORSTL
V. J. Cassella, DOE/HQ (RW-22), FORSTL
Ralph Stein, DOE/HQ (RW-23), FORSTL
E. S. Burton, DOE/HQ (RW-25), FORSTL
J. O. Neff, DOE/SRPO, Columbus, OH
S. A. Mann, DOE/CRPO, Argonne, IL
O. L. Olson, DOE/RL, Richland, WA
R. W. Taft, AMES, DOE/NV
L. E. Perrin, RMBD, DOE/NV
A. J. Roberts, RMBD, DOE/NV
T. O. Hunter, SNL, 6310, Albuquerque, NM
R. W. Lynch, SNL, 6300, Albuquerque, NM
W. W. Dudley, Jr., USGS, Denver, CO
L. D. Ramspott, LLNL, Livermore, CA
D. T. Oakley, LANL, Los Alamos, NM
J. B. Wright, W/WTSD, Mercury, NTS
M. E. Spaeth, SAIC, Las Vegas, NV
J. R. LaRiviere, SAIC, Las Vegas, NV
W. S. Twenhofel, SAIC, Lakewood, CO
J. H. Fiore, SAIC, Las Vegas, NV
R. R. Loux, NWPO, Carson City, NV
C. H. Johnson, NWPO, Carson City, NV
P. T. Prestholt, NRC/Las Vegas, NV
David Siefken, Weston, Rockville, MD
Robert Jackson, Weston, Rockville, MD
William McClain, Weston, Rockville, MD
Terrence Bates, Weston, Rockville, MD
Curtiss Haymore, Weston, Rockville, MD

DOE GENERIC SCP ANNOTATED OUTLINE

PRESENTATION TO: NEVADA NUCLEAR WASTE
PROJECT OFFICE - MR. ROBERT LOUX

PRESENTATION BY: NEVADA NUCLEAR WASTE
STORAGE INVESTIGATIONS PROJECT - WASTE
MANAGEMENT PROJECT OFFICE - MR. MAXWELL BLANCHARD

WHY DOE MET WITH NRC ON REG GUIDE 4.17

(1) o DOE WILL BE SUBMITTING AT LEAST THREE SCPs IN A ONE YEAR PERIOD

(2) o REG GUIDE 4.17 HAS NEVER BEEN USED AND THUS NO PRECEDENT EXISTS

(3) o A PROPOSED LICENSING PROCEDURES AMENDMENT TO 10 CFR 60 HAD BEEN ISSUED

(4) o REG GUIDE 4.17 WAS IN DRAFT FORM

(5) o DOE DESIRED TO MINIMIZE ANY PROBLEMS THAT COULD ARISE FROM INDEPENDENT (PROJECT) INTERPRETATION OF REG GUIDE 4.17 CONTENT

PREPARATION OF A GENERIC SCP AO (I)

- THE SCP AO EXERCISE FOCUSED ON:

  1) DEVELOPING A PROGRAM WIDE CONSISTENT INTERPRETATION OF THE REQUIREMENTS OF REG GUIDE 4.17

  2) DEVELOPING A COMPROMISE AO THAT ALL THREE PROJECTS COULD USE TO PREPARE SCPs

  3) MEETING WITH NRC STAFF TO IDENTIFY TOPICAL PRESENTATION APPROACHES OR INTERPRETATIONS THAT WERE IN CONFLICT WITH NRC STAFF INTERPRETATIONS

- THE DOE PLAN FOR STATE INVOLVEMENT WAS TO OBTAIN NRC ACKNOWLEDGEMENT THAT THE SCPAO REPRESENTED AN ACCEPTABLE INTERPRETATION OF REG GUIDE 4.17, AND THEN TO FURNISH THE AO TO STATES FOR COMMENT

PREPARATION OF A GENERIC SCP AO

THE SCP AO EXERCIZE WAS NOT:

1) A FORMAL DOE COMMENTARY ON THE CONTENT OF REG GUIDE 4.17

2) A SCOPING MEETING FOR NRC TO ENTERTAIN CONCEPTS OR TOPICS TO BE TREATED IN THE SCP

3) AN ATTEMPT TO PREPARE AN AO THAT COVERED SITE SPECIFIC CONCERNS IN DETAIL

SPECIFIC RESPONSES TO CONCERNS RAISED IN LOUX LETTER (MAY 7, 1985) I

1) CONCERN FOR "SCOPING THE SITE CHARACTERIZATION PLANS"

- NWPA 112(B)2:

> (2) Before nominating any site the Secretary shall hold public hearings in the vicinity of such site to inform the residents of the area in which such site is located of the proposed nomination of such site and to receive their comments. At such hearings, the Secretary shall also solicit and receive any recommendations of such residents with respect to issues that should be addressed in the environmental assessment described in paragraph (1) and the site characterization plan described in section 113(b)(1).

- NWPA 113(B)1:

> (b) COMMISSION AND STATES.—(1) Before proceeding to sink shafts at any candidate site, the Secretary shall submit for such candidate site to the Commission and to either the Governor and legislature of the State in which such candidate site is located, or the governing body of the affected Indian tribe on whose reservation such candidate site is located, as the case may be, for their review and comment—

- NO SPECIFIC NWPA REQUIREMENT FOR "SCOPING" HEARINGS FOR SCP

SPECIFIC RESPONSES TO CONCERNS RAISED
IN LOUX LETTER (MAY 1, 1985) II

o DOE HELD PUBLIC HEARINGS AS REQUIRED BY NWPA 112(B)2

NVO-263 NVO-263

Nevada
Nuclear
Waste
Storage
Investigations
A U.S. DOE PROJECT

PUBLIC HEARINGS PANEL REPORT

A SUMMARY OF PUBLIC CONCERNS REGARDING THE CHARACTERIZATION OF A REPOSITORY SITE IN NEVADA

NOVEMBER 1983

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE
LAS VEGAS, NEVADA

SPECIFIC RESPONSES TO CONCERNS RAISED
IN LOUX LETTER (MAY 1, 1985) II (CONTINUED)

PUBLIC HEARINGS

- INFORMATION DOCUMENT CONTAINED REG GUIDE 4.17
- INFORMATION DOCUMENT CONTAINED DRAFT 10 CFR 960
- NEVADA DEPARTMENT OF ENERGY SUBMITTED WRITTEN COMMENTS ON ISSUES TO BE ADDRESSED IN EA AND SCP
- MR. LOUX DESCRIBED EXPECTATIONS OF THE STATE OF NEVADA FOR EA AND SCP CONTENT

HEARING PANEL REPORT

- CONCERNS EXPRESSED HAVE BEEN REVIEWED: EA CONCERNS WERE TREATED IN DRAFT EA; SCP CONCERNS WILL BE TREATED IN SCP

SPECIFIC RESPONSES TO CONCERNS RAISED
IN LOUX LETTER (MAY 1, 1985) III

CONCERNS WITH "CONTENT OF THE ANNOTATED OUTLINE (AO)"

- "WE WERE RIGHTFULLY DISTURBED TO READ IN THE APRIL 3 LETTER THAT YOUR OFFICE MET ON FEBRUARY 13 WITH NRC TO DISCUSS THE ANNOTATED OUTLINE FOR SCPs"

  - OCT. 4-5 NNWSI PROJECT TPO MEETING (JOHNSON PRESENT)

    - DISCUSSED HESITANCY TO USE DRAFT REG GUIDE 4.17 TO PREPARE SCP

    - REVIEWED BWIP APPROACH TO CHAPTER 10 AND COMPARED TO NNWSI ISSUE HIERARCHY APPROACH

    - REPORTED ON NNWSI PROJECT AO PREPARATION

    - COMPARED REG GUIDE 4.17 TO CIRCULATING DRAFT

    - HANDED OUT NNWSI PROJECT TOPICAL OUTLINE

  - NOV. 28-29 NNWSI PROJECT TPO MEETING (LOUX PRESENT)

    - DISCUSSED HQ MEETING ON AO

    - NOTED BWIP & NNWSI WERE WORKING ON COMMON AO

    - STEIN LETTER DIRECTING PROJECTS TO PREPARE GENERIC AO

    - DISCUSSED SCP SCHEDULE ASSUMPTIONS

SPECIFIC RESPONSES TO CONCERNS RAISED
IN LOUX LETTER (MAY 1, 1985) III (CONTINUED)

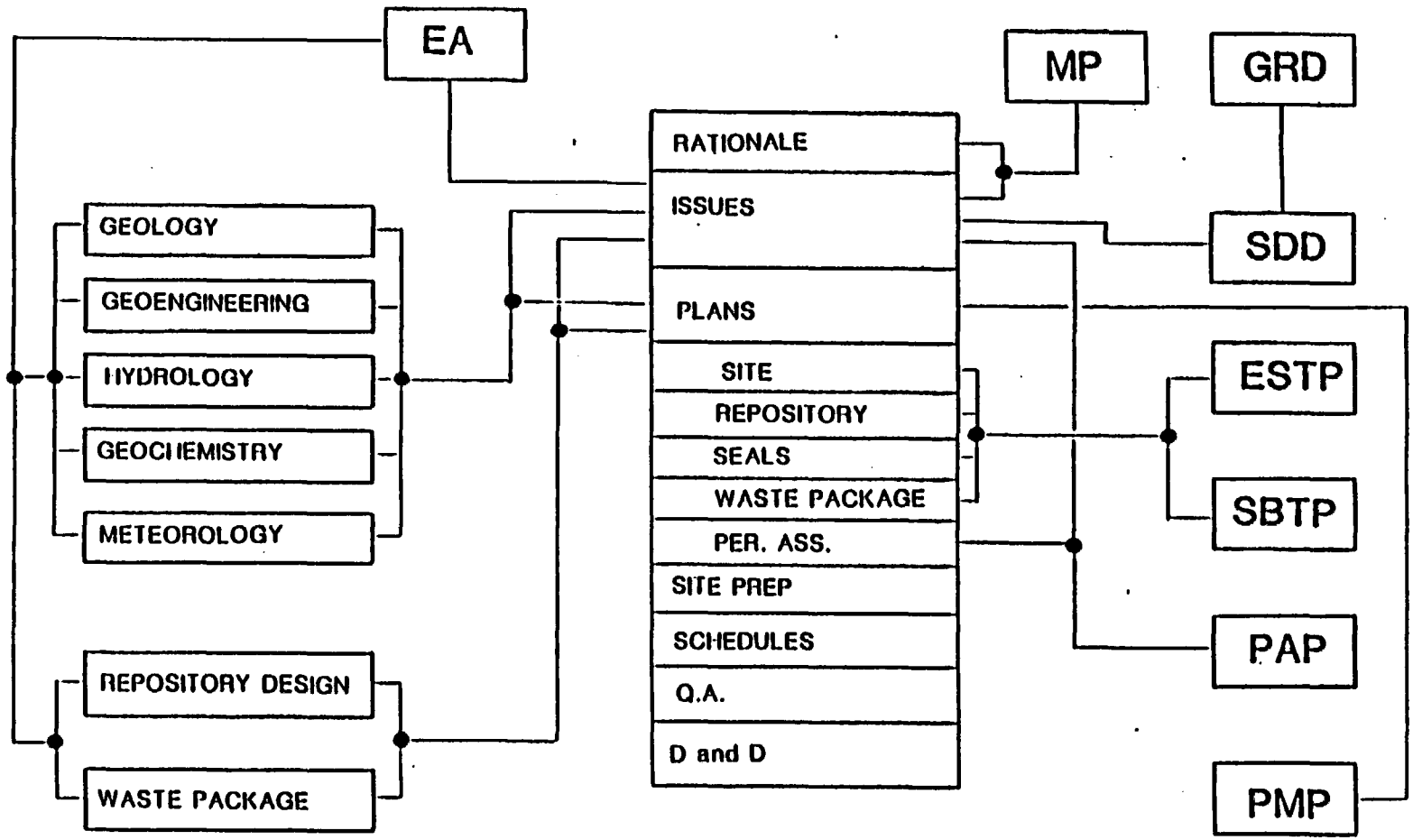
- o JAN. 31-FEB. 1 NNWSI PROJECT TPO MEETING (JOHNSON PRESENT)
  - REVIEWED AO BACKGROUND AND DEVELOPMENT PROCESS

    (SEPARATE VIEWGRAPH)
  - PRESENTED MANAGEMENT PLAN CONCEPTS

- o FEB. 21-22 NNWSI PROJECT TPO MEETING (JOHNSON PRESENT)
  - SUMMARIZED FEB. 13 MEETING WITH NRC
  - NOTED NRC WILL STILL JUDGE SCPs AGAINST REG GUIDE 4.17
  - NOTED NEXT STEP IN PROCESS WAS TO REQUEST COMMENTS FROM STATES REGARDING SCP CONTENT

NNWSI PROJECT

SCP ANNOTATED OUTLINE : CONCEPTS



Part A

Part B

RELATIONSHIP OF PLANS TO EXISTING DATA

- REG GUIDE 4.17 DID NOT RELATE PLANS TO EXISTING DATA
- AO CONTAINS DATA CHAPTER INTRODUCTIONS TO GUIDE READER IN REVIEWING DATA WITH REGARD TO PLANS FOR ADDITIONAL DATA
- AO CONTAINS DATA CHAPTER SUMMARIES TO DEVELOP THESE RELATIONSHIPS
- BASED UPON CLEARLY DEFINED RELATIONSHIP BETWEEN REGULATIONS, DESIGN AND INFORMATION NEEDED -- I.E., THE ISSUE HIERARCHY

SPECIFIC RESPONSES TO CONCERNS RAISED
IN LOUX LETTER (MAY 1, 1985) IV

- MEETING MINUTES

  1) NRC DID RECEIVE THE SCP AO PRIOR TO THE FEB. 13 MEETING - APPROXIMATELY 1 WEEK PRIOR TO MEETING

  2) NWPO DID NOT RECEIVE A COPY OF THE AO PRIOR TO MEETING - DOE HQ PLAN WAS TO MEET WITH NRC REGARDING INTERPRETATION OF REG GUIDE 4.17 PRIOR TO REQUESTING STATE COMMENTS

  3) A MEETING ANNOUNCEMENT WAS NOT SENT TO STATE - HOWEVER, STATE WAS AWARE OF ACTIVITY THROUGH TPO MEETINGS

  4) COMMENTS WERE NOT SOLICITED FROM STATE UNTIL APRIL 3 - SEE #2

- THE NNWSI PROJECT DOES NOT CONSIDER STATE COMMENTS TO BE OF QUESTIONABLE VALUE - THEY WILL BE ADDRESSED IN SCP

- THE YUCCA MOUNTAIN SCP WILL ADDRESS ALL SITE SPECIFIC ISSUES THROUGH USE OF ISSUE HIERARCHY. THE CONTENT OF EACH CHAPTER WILL BE REVIEWED FOR COMPLETENESS IN ADDRESSING ALL KNOWN ISSUES, PARTICULARLY THOSE RAISED IN EA COMMENTS

DATA CHAPTER INTRODUCTION

2.0 INTRODUCTION

This section will introduce the site Geoengineering to indicate the role in the site characterization program of the material covered in the chapter. This section will include in a brief introductory fashion:

- Summary remarks about how the presently available information has been obtained and plans for obtaining additional information
- Summary remarks about how the information will be used
- Discussions about conceptual models that are based upon or are supported by the information contained in the chapter
- Discussions about the quality of present data and the sophistication of models which will use the data.

DATA CHAPTER SUMMARY

2.9 SUMMARY

This section will link the data and analyses presented in Part A - Chapter 2 to Part B of the Site Characterization Plan.

2.9.1 Summary of Significant Results

This subsection will present a synopsis of the significant results recorded in Chapter 2 in terms of:

- Performance objectives
- Conceptual models and boundary conditions
- Need for further data from site characterization
- Quality of the data, including uncertainties.

Cross-references to other parts of the SCP will be provided.

2.9.2 Relation to Design

This section will summarize the significant interrelationships between the information presented in this chapter and the design characteristics discussed in Chapters 6 and 7.

2.9.3 Identification of Information Needs

Information needs relevant to geoengineering will be identified in this section. The relationship to Part B will be discussed, and a preliminary priority of information needed to complete site characterization will be presented.

2.9.4 Relation to Regulatory Guide 4.17

This section will present a site-specific synopsis of the information requested in Reg. Guide 4.17 which has not been shown to be a requirement for this SCP.

SCP TREATMENT OF SPECIFIC COMMENTS - LOUX LETTER MAY 1, 1985

CONCERN	ISSUE	INFORMATION NEED
VOLCANIC HISTORY	What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?	Rates and magnitudes of potential igneous activity. Rates and magnitudes of potential fault movement, uplift, and seismic activity. Potential effects of igneous and tectonic activity on hydrologic, geochemical, and rock characteristics.
STRUCTURAL HISTORY	What are the present and expected characteristics of the host rock and surrounding units that must be known to determine compatibility with containment and isolation? What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?	Locations and characteristics of structural features. Potential effects of igneous and tectonic activity on hydrologic, geochemical, and rock characteristics.
SEISMICITY OF CANDIDATE AREA	What are the expected tectonic phenomena and igneous activity that must be known to determine if repository construction, operation, closure, and decommissioning are feasible? What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?	Potential fault movements at the site. Ground-motion at the site from potential man-made or natural seismic events. Rates and magnitudes of potential fault movement, uplift, and seismic activity.
INDUCED SEISMICITY	What are the expected tectonic phenomena and igneous activity that must be known to determine if repository construction, operation, closure, and decommissioning are feasible?	Ground-motion at the site from potential man-made or natural seismic events.

SCP TREATMENT OF SPECIFIC COMMENTS - LOUX LETTER MAY 1, 1985

CONCERN	ISSUE	INFORMATION NEED
MINERAL RESOURCES	What are the natural resources at or near the site that could cause human interference activities that could lead to radionuclide releases greater than those allowed by regulations?	Present and future value of energy, mineral, land, and ground-water resources. Potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics.
HYDRAULIC CHARACTERISTICS	What are the present and expected characteristics of the geohydrologic setting that must be known to determine compatibility with containment and isolation?	Conceptual models of ground-water flow in the unsaturated zone within the boundaries of the accessible environment.
UNSATURATED ZONE RELATIONSHIPS		Flow paths, fluxes, and velocities of water and gases in the unsaturated zone.
LOCAL GROUNDWATER USERS	What are the present and projected social and economic conditions considered sufficient to assess social and economic impacts?	
	What are the hydrologic characteristics and conditions that must be known to determine if construction, operation, closure and decommissioning of a repository are feasible?	Location of adequate water supplies.
GROUNDWATER GEOCHEMISTRY	What are the present and expected geochemical characteristics that must be known to determine compatibility with containment and isolation?	Water chemistry within the potential emplacement horizon and along potential flow paths.

SCP TREATMENT OF SPECIFIC COMMENTS - LOUX LETTER MAY 1, 1985

CONCERN	ISSUE	INFORMATION NEED
PALEOCLIMATOLOGY FUTURE CLIMATIC VARIATION	What are the future climatic conditions that must be known to determine if radionuclide releases will be greater than those allowed by regulations?	Ranges of future climatic conditions. Potential effects of future climatic conditions on hydrologic, geochemical, and rock characteristics.
CURRENT REPOSITORY DESIGN DESCRIPTION DESIGN OF UNDERGROUND OPENINGS	Can the repository be constructed, operated, closed, and decommissioned with reasonably available technology?	Site information needed for design. Characteristics and quantities of waste and waste packages needed for design. Potential impacts of rock characteristics on design. Potential impacts of hydrologic characteristics on design. Potential impacts of tectonic activity on design. Determination that the underground facilities can be constructed, operated, closed, and decommissioned with reasonably available technology.
DESIGN DESCRIPTIONS	What are the characteristics and configuration of the waste package that must be known to show that interactions with the emplacement environment do not compromise the function of the waste packages, the performance of the underground facility, or the geologic setting?	Reference waste package designs.
	What characteristics and configurations of the underground facility contribute to containment and isolation?	Reference postclosure underground facility designs.

SCP TREATMENT OF SPECIFIC COMMENTS - LOUX LETTER MAY 1, 1985

CONCERN	ISSUE	INFORMATION NEED
GEOLOGY	What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?	Rates and magnitudes of potential igneous activity.
HYDROLOGY	What are the present and expected characteristics of the geohydrologic setting that must be known to determine compatibility with containment and isolation?	Description of the hydrogeology. Description of the regional hydrologic system. Hydrologic characteristics at the site.
RESOURCE POTENTIAL	What are the natural resources at or near the site that could cause human interference activities that could lead to radionuclide releases greater than those allowed by regulations?	Present and future value of energy, mineral, land, and ground-water resources. Potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics.

CONCERN	COMMENT
o COUPLED INTERACTION TESTS	o NRC HAS ISSUED INFORMATION THAT SUGGESTS THAT A LICENSE APPLICANT IS NOT REQUIRED TO CHARACTERIZE NEAR FIELD HOST ROCK THAT IS NOT CONSIDERED IN CALCULATION OF PERFORMANCE. DOE HAS PROPOSED MEETINGS WITH NRC TO DISCUSS THIS TOPIC
o MILESTONES AND SCHEDULES	o REG GUIDE 4.17 ASKS FOR INFORMATION ON USE OF DATA FOLLOWING SITE CHARACTERIZATION (REQUEST CLARIFICATION ON NWPA PARA. 113 REFERENCE TO EIS MARKING END OF SITE CHARACTERIZATION) o NOT CLEAR THAT STATE INTERACTIONS FALL WITHIN NWPA DEFINITION OF SITE CHARACTERIZATION

CONCERN	COMMENT
o STRESS FIELD	o THE WORD "FIELD" HAS MATHEMATICAL CONNOTATIONS THAT WERE FELT TO BE INAPPROPRIATE IN THE CONTEXT OF IN SITU MEASUREMENTS. NO INTENT TO SUGGEST THAT THE THREE DIMENSIONAL NATURE OF THE STRESS REGIME WOULD NOT BE INVESTIGATED
o EVOLUTION OF GROUNDWATER	o THE INTENT WAS TO PROVIDE AGE DATES AS WELL AS INFORMATION RELATIVE TO GROUNDWATER ORIGIN AND MOVEMENT
o RADIOACTIVE MATERIALS AND ISOLATION CAPABILITY	o THE TOPICS WERE CONSIDERED SO IMPORTANT THAT EACH SPECIFIC SECTION OF CHAPTER 8.3 IS ARRANGED SO THAT EACH TEST WILL BE EXAMINED IN THIS CONTEXT (SEE P. 57, P. 59, P. 61 AND P. 62)

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Nevada Nuclear Waste Storage Investigations PROJECT

AN ISSUES HIERARCHY APPROACH TO SITE CHARACTERIZATION AND REGULATORY COMPLIANCE

PRESENTATION FOR THE

OFFICE OF GEOLOGIC REPOSITORIES

MAY 17, 1985

U.S. DEPARTMENT OF ENERGY

N-BR.Clark.05/08/85

U.S. DEPARTMENT OF ENERGY

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Nevada Nuclear Waste Storage Investigations PROJECT

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ISSUES HIERARCHY

LOGIC OF AN ISSUES HIERARCHY APPROACH TO SITE CHARACTERIZATION AND REGULATORY COMPLIANCE

- ISSUES AND INFORMATION NEEDS ARE DERIVED BY ANALYSIS OF REGULATORY REQUIREMENTS (NWPA, NEPA, 10CFR60, 40CFR191, 10CFR20, 10CFR51, 10CFR960)
- ISSUES HIERARCHY IS EXPLICITLY TIED TO THE MISSION PLAN AND THE SITING GUIDELINES
- ISSUES HIERARCHY ESTABLISHES THE "NECESSARY AND SUFFICIENT" INFORMATION NEEDED FOR PROJECT COMPLETION
- ISSUES HIERARCHY ESTABLISHES LOGICAL MANNER IN WHICH SITE CHARACTERIZATION, ENVIRONMENTAL, AND REPOSITORY DESIGN INFORMATION WILL BE USED TO RESOLVE LICENSING ISSUES
- ISSUES HIERARCHY PROVIDES HIERARCHICAL FRAMEWORK FOR TECHNICAL WORK PLANS
- A SYSTEMATIC ISSUES RESOLUTION STRATEGY CAN BE DEVELOPED USING THE STRUCTURE OF THE HIERARCHY

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Nevada Nuclear Waste Storage Investigations PROJECT

ISSUES HIERARCHY

ISSUES HIERARCHY STRUCTURE

KEY ISSUES: MISSION PLAN KEY ISSUES

ISSUES: THE LIST OF "NECESSARY AND SUFFICIENT" QUESTIONS THAT MUST BE ANSWERED IN ORDER FOR THE KEY ISSUE TO BE RESOLVED

INFORMATION NEEDS: THE LIST OF "NECESSARY AND SUFFICIENT" INFORMATION THAT IS REQUIRED IN ORDER FOR THE ISSUE TO BE RESOLVED

BASIC PREMISE: IF CONTROLLING LAWS AND REGULATIONS ARE ACCURATELY REFLECTED IN THE ISSUES HIERARCHY THEN,
RESOLUTION OF THE ISSUES AND KEY ISSUES WILL COVER ALL REQUIREMENTS FOR REPOSITORY SITING, CONSTRUCTION, OPERATION, CLOSURE AND DECOMMISSIONING.

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Nevada Nuclear Waste Storage Investigations PROJECT

ISSUES HIERARCHY

STEPS IN DEVELOPMENT OF NNWSI PROJECT ISSUES HIERARCHY

- ADOPT MISSION PLAN KEY ISSUES
- UNDERSTAND STRUCTURE AND CONTENT OF REGULATIONS
- SCREEN POTENTIAL REGULATORY QUESTIONS AND DETERMINE THOSE QUESTIONS THAT SHOULD BE DESIGNATED AS ISSUES
- DETERMINE THE INFORMATION REQUIRED TO RESOLVE ISSUES AND DESIGNATE AS INFORMATION NEEDS
- PERFORM "NECESSARY AND SUFFICIENT TEST" ON
  - ISSUES WITHIN KEY ISSUES
  - INFORMATION NEEDS WITHIN ISSUES

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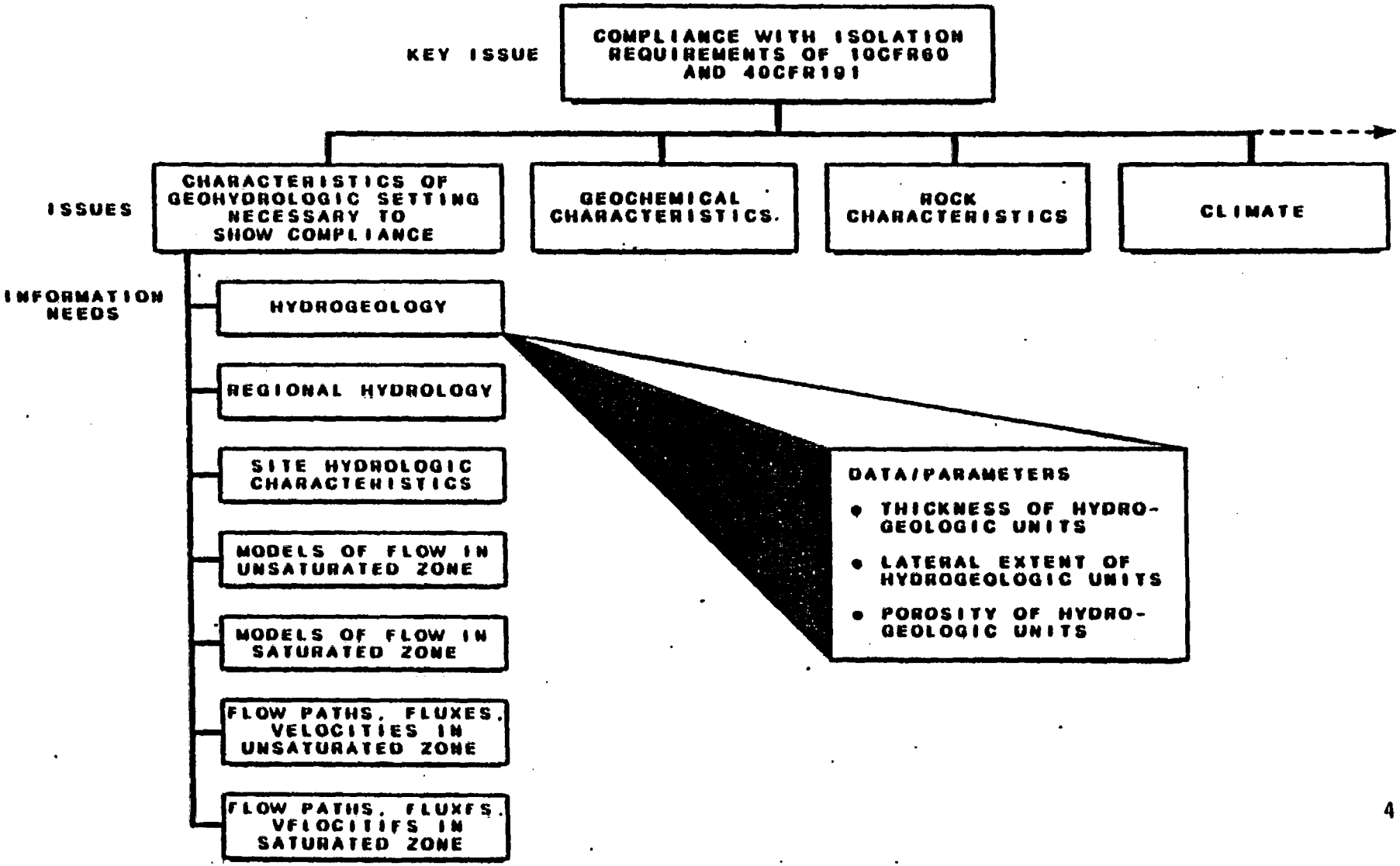
ISSUES & INFORMATION NEEDS



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OCRWM OGR — Nevada Nuclear Waste Storage Investigations PROJECT — Yucca Mountain

ISSUE CATEGORIES

HELP TO ESTABLISH THE INTERNAL LOGIC WITHIN EACH KEY ISSUE

CHARACTERIZATION ISSUES:	THE SITE CHARACTERISTICS AND CONDITIONS THAT AFFECT REPOSITORY DESIGN, PERFORMANCE, AND ENVIRONMENTAL IMPACTS
DESIGN ISSUES:	DESIGN ELEMENTS OF THE ENTIRE GEOLOGIC REPOSITORY SYSTEM THAT ARE ESSENTIAL FOR DETERMINATION OF COMPLIANCE WITH REGULATORY REQUIREMENTS
PERFORMANCE ISSUES:	ANALYSES NECESSARY TO ASSESS THE SUITABILITY OF THE SITE AND ENGINEERED SYSTEMS AS A LICENSABLE GEOLOGIC REPOSITORY

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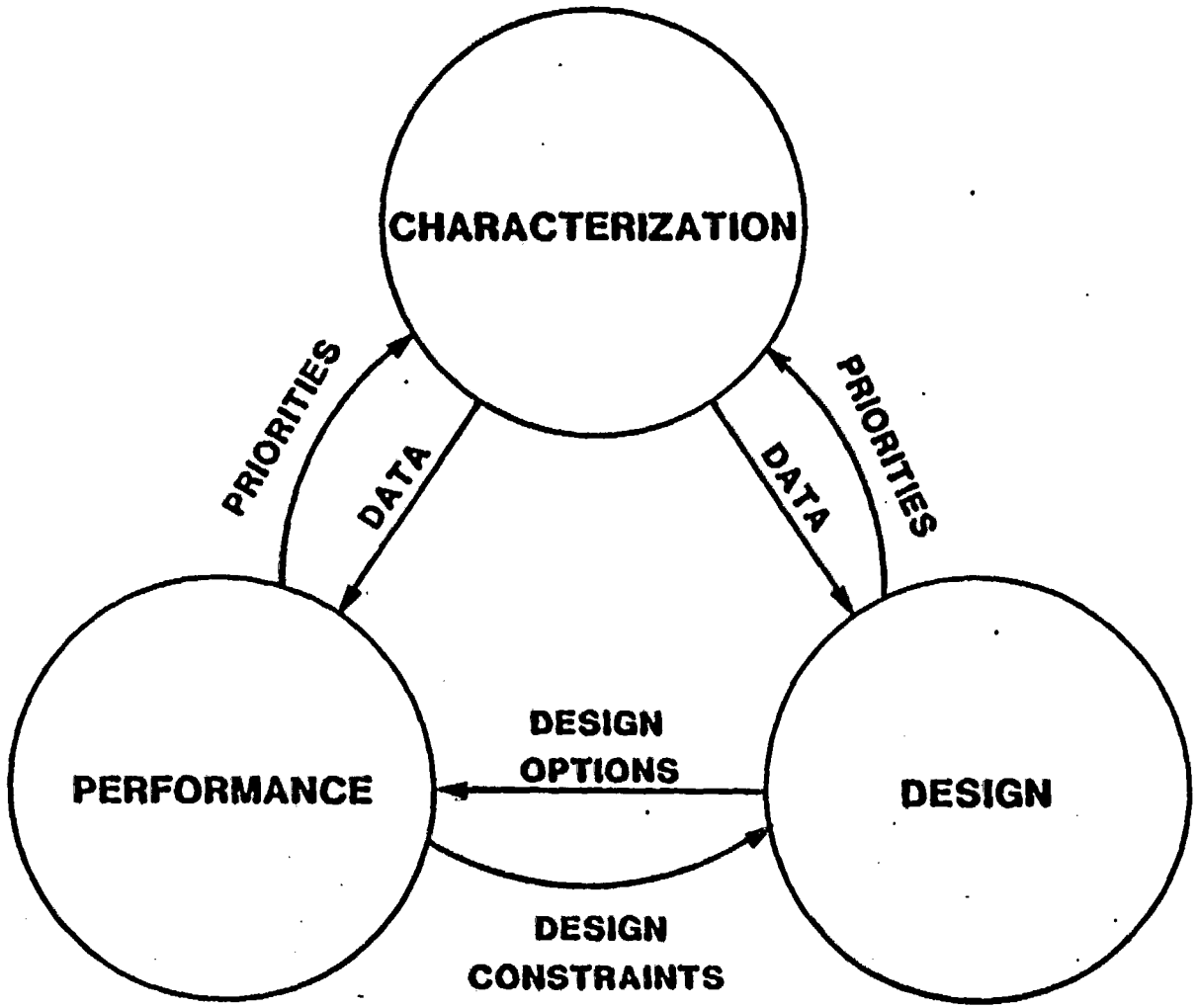
OCRWM OGR Nevada Nuclear Waste Storage Investigations PROJECT Yucca Mountain

RELATIONSHIPS AMONG THREE TYPES OF NNWSI ISSUES



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ISSUES HIERARCHY

ISSUES HIERARCHY PROVIDES UNDERLYING LOGIC FOR PROJECT PLANS

- SYSTEMATICALLY DEFINES PROJECT REQUIREMENTS WITHIN A HIERARCHICAL FRAMEWORK
- INFORMATION NEEDS CAN BE CLASSIFIED PER NWPA AS SITE CHARACTERIZATION OR NON-SITE CHARACTERIZATION
- SITE CHARACTERIZATION INFORMATION NEEDS CAN BE MAPPED TO CHAPTER 8 OF THE SCP, SECTION 8.3: SITE, REPOSITORY, SEALS, WASTE PACKAGE, AND PERFORMANCE ASSESSMENT
- NON-SITE CHARACTERIZATION INFORMATION NEEDS CAN BE MAPPED TO OTHER PROJECT DOCUMENTS WHERE THEY WILL BE ADDRESSED
- FOR EACH INFORMATION NEED: A DETAILED DISCUSSION WILL BE WRITTEN EXPLAINING
  - -- WHY THE NEED EXISTS
  - -- TECHNICAL BASIS FOR ADDRESSING THE NEED
    - DATA/PARAMETERS TO BE COLLECTED
    - LOGIC FOR HOW THE INFORMATION NEED WILL BE SATISFIED ("NECESSARY AND SUFFICIENT" TEST FOR DATA/PARAMETERS)
  - -- HOW THE TESTS, ANALYSES, OR STUDIES WILL BE CONDUCTED (REFERENCES TO TEST PLANS)

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Nevada Nuclear Waste Storage Investigations PROJECT

MATRIX FOR CROSS REFERENCING ISSUES HIERARCHY TO OTHER PLANS/PROJECT DOCUMENTS

	KEY ISSUE 1.0	ISSUES	INFORMATION NEEDS	KEY ISSUE 2.0	ISSUES	INFORMATION NEEDS	KEY ISSUE 3.0	ISSUES	INFORMATION NEEDS	KEY ISSUE 4.0	ISSUES	INFORMATION NEEDS
SAR. FINDINGS. REC. SUPP.	●	●	●	●	●	●	●	●	●	●	●	●
ENVIRONMENTAL IMPACT STM.	●			●			●	●	●	●		
SOC. FIELD ACT. PLAN								●	●			
METEOROLOGICAL MONITORING PLAN					●	●						
ENV. FIELD ACT. PLAN								●	●			
RADIOLOGICAL MONITORING PLAN					●	●	●	●	●			
ENVIRONMENTAL PERMIT PLANS			●			●	●		●			
SURFACE INV. PLAN		●	●								●	●
REPOSITORY SEALING PLAN		●	●									
SYSTEM DESCRIPTION DOCUMENT					●	●					●	●
REPOSITORY DESIGN PLAN		●	●		●	●		●	●	●	●	●
CONCEPT. DESIGN PLAN		●	●		●	●		●	●	●	●	●
PERFORMANCE ASSESSMENT PLAN	●	●	●									
EXPLORATORY SHAFT TEST PLAN		●	●								●	●
SITE CHARACTERIZATION PLAN		●	●		●	●					●	●

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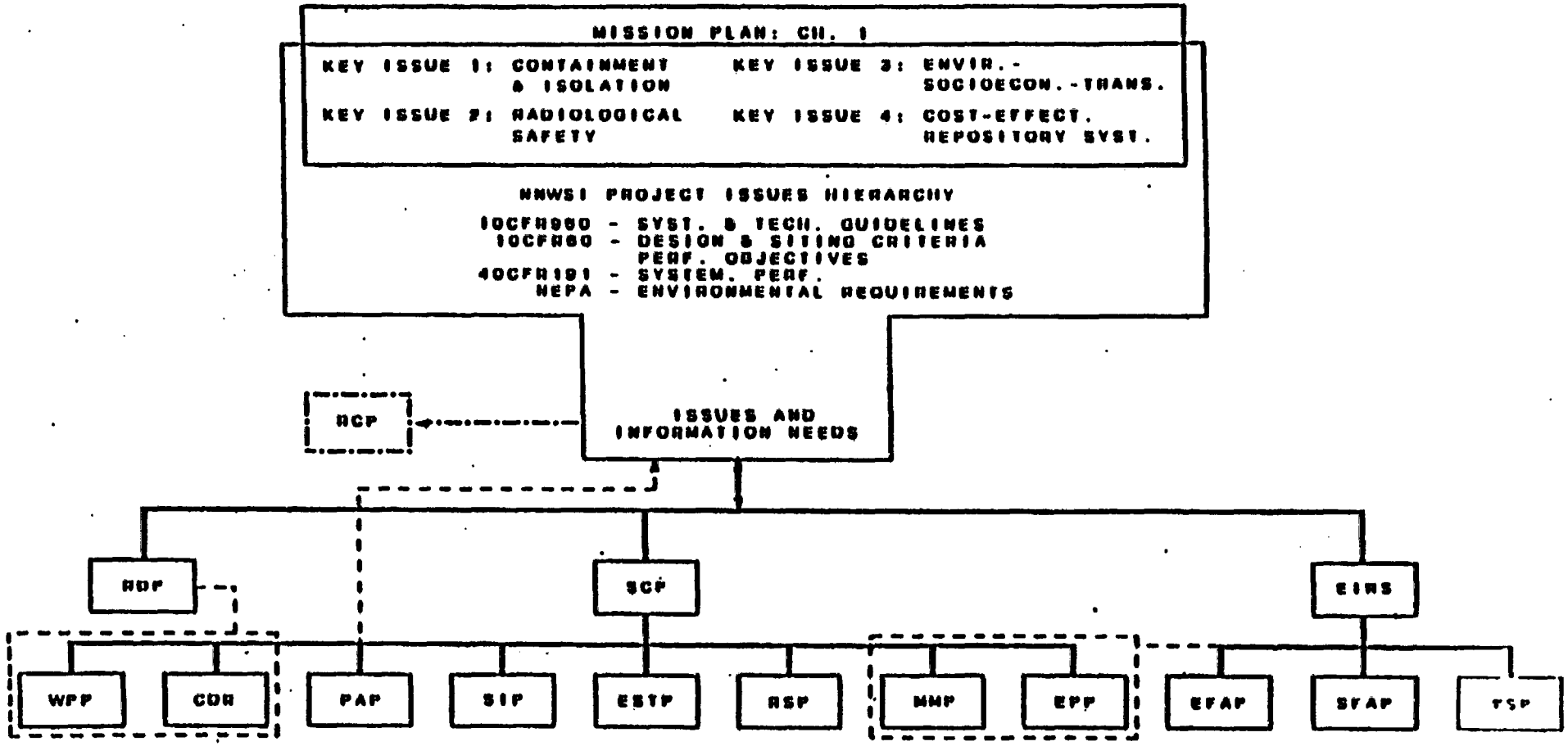
Nevada Nuclear Waste Storage Investigations PROJECT

OGA

MISSION PLAN - ISSUES HIERARCHY - PROJECT TECHNICAL PLANS



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Nevada Nuclear Waste Storage Investigations PROJECT

YUCCA MOUNTAIN

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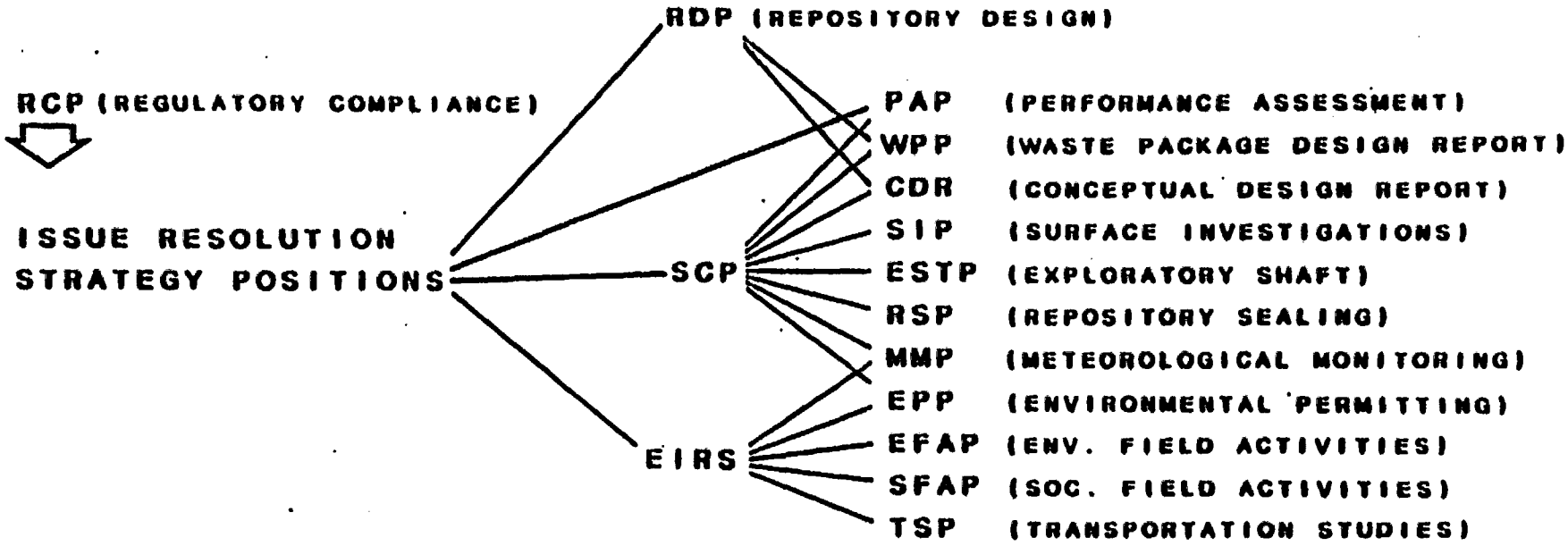
PLANS HIERARCHY

PLANS TO DEMONSTRATE COMPLIANCE

PLANS TO GATHER DATA, CONDUCT STUDIES, OR PERFORM ANALYSES



(ENVIRONMENTAL INVESTIGATIONS REQUIREMENTS STUDY)

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KEY ISSUE 1

POSTCLOSURE PERFORMANCE

10CFR60 40CFR191

CHARACTERIZATION ISSUES 10CFR960
GEOHYDROLOGIC SETTING
GEOCHEMICAL SETTING
HOST ROCK CHARACTERISTICS
FUTURE CLIMATIC CONDITIONS
FUTURE EROSIONAL RATES AND PROCESSES
FUTURE ROCK DISSOLUTION
FUTURE TECTONIC PROCESSES AND EVENTS
POTENTIAL HUMAN INTERFERENCE ACTIVITIES

DESIGN ISSUES 10CFR60
WASTE PACKAGE DESIGN
UNDERGROUND FACILITY DESIGN
SEAL DESIGN

PERFORMANCE ISSUES 10CFR60, 40CFR191, 10CFR960
REPOSITORY EFFECTS ON SITE CHARACTERISTICS
WASTE PACKAGE CONTAINMENT
ENGINEERED BARRIER RELEASES
1000-YR TRAVEL TIME
EFFECTS OF FAVORABLE AND POTENTIALLY ADVERSE CONDITIONS
TOTAL SYSTEM PERFORMANCE
HIGHER LEVEL FINDINGS ON TECHNICAL GUIDELINES

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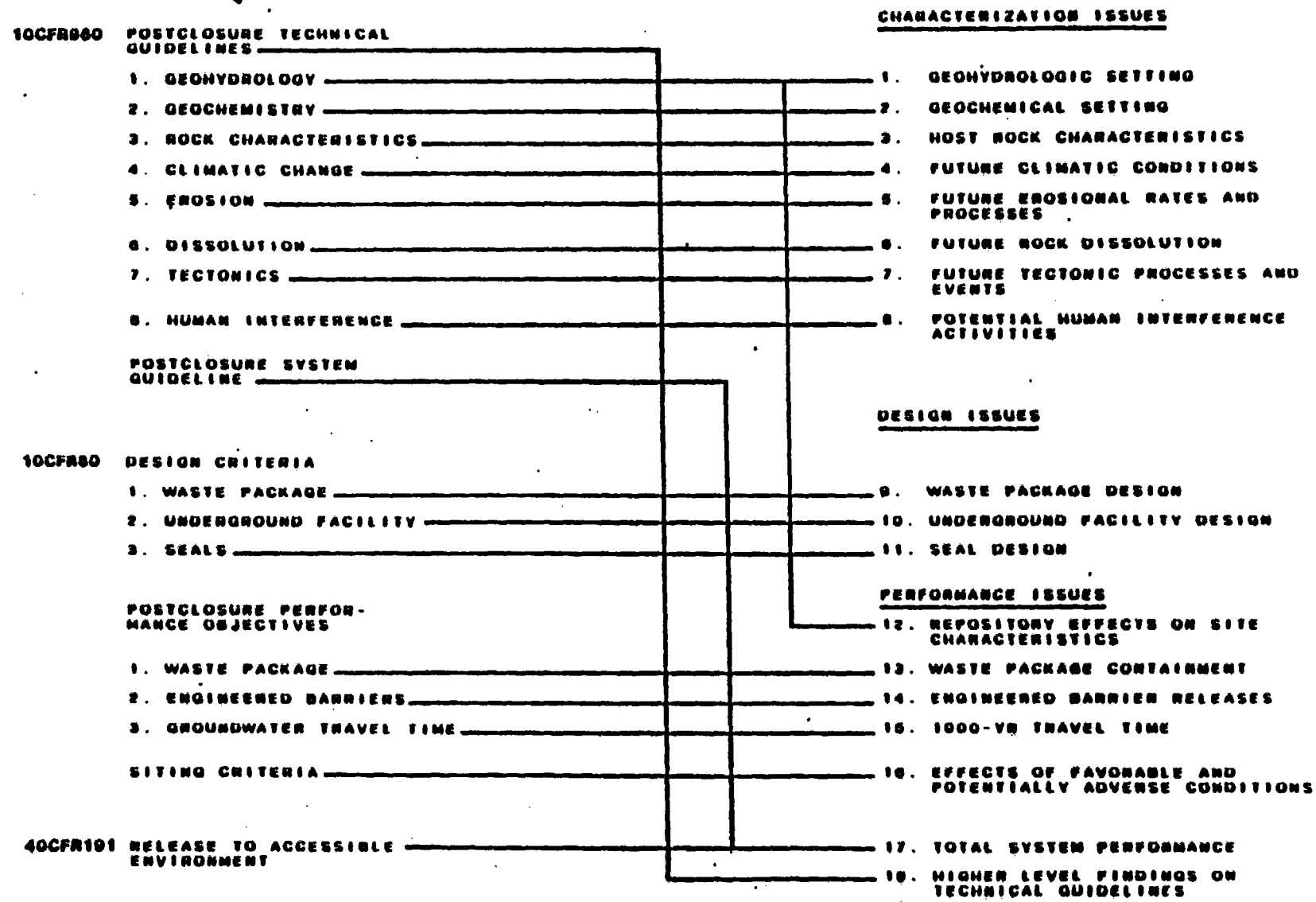
OCRWM OGR — Nevada Nuclear Waste Storage Investigations PROJECT — Yucca Mountain

KEY ISSUE 1

POSTCLOSURE PERFORMANCE



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KEY ISSUE 2

PRECLOSURE
RADIOLOGICAL SAFETY

10CFR20, 10CFR60, 40CFR191

CHARACTERIZATION ISSUES 10CFR960	DESIGN ISSUES 10CFR60, 10CFR20	PERFORMANCE ISSUES 10CFR20, 40CFR191 10CFR960
POPULATION DENSITY AND DISTRIBUTION STATUS OF LAND OWNERSHIP AND MINERAL RIGHTS METEOROLOGICAL CONDITIONS PRESENCE AND CHARACTERISTICS OF OFFSITE INSTALLATIONS & OPERATIONS	WASTE PACKAGE DESIGN GEOLOGIC REPOSITORY DESIGN	RELEASE TO RESTRICTED & UNRESTRICTED AREAS HIGHER LEVEL FINDINGS ON TECHNICAL GUIDELINES

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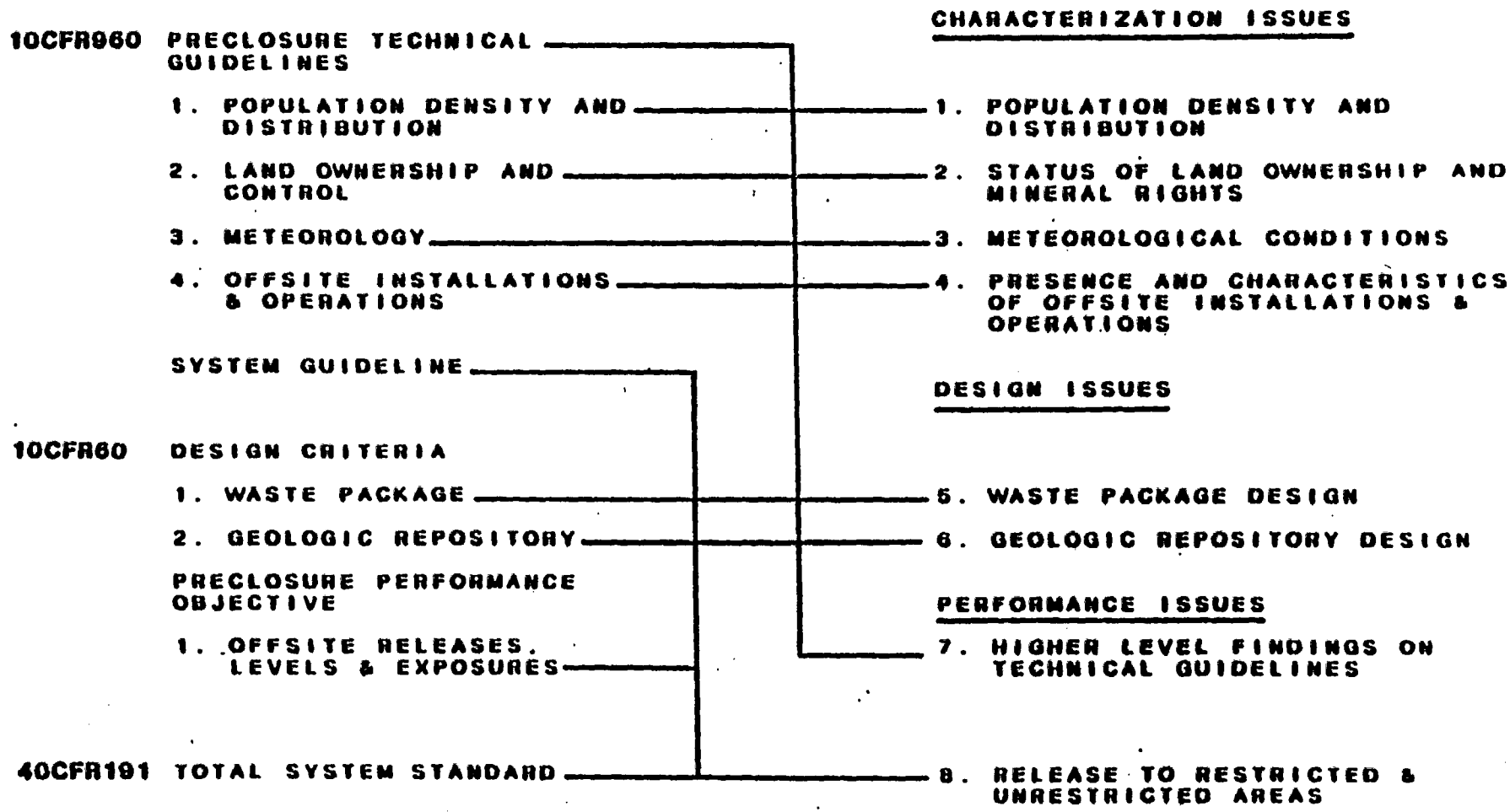
KEY ISSUE 2

PRECLOSURE
RADIOLOGICAL SAFETY



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KEY ISSUE 3

PRECLOSURE ENVIRONMENTAL, SOCIOECONOMIC, & TRANSPORTATION IMPACTS

10CFR960, NEPA, CEQ, FEDERAL, STATE & LOCAL REGULATIONS

CHARACTERIZATION ISSUES 10CFR960	DESIGN ISSUES NEPA, CEQ, FEDERAL, STATE & LOCAL REGS.	ASSESSMENT ISSUES 10CFR960, NEPA, CEQ, FEDERAL, STATE & LOCAL REGS.
BASELINE ENVIRONMENTAL CONDITIONS	SITE/DESIGN INFORMATION NECESSARY FOR ENVIRONMENTAL IMPACT ASSESSMENT	PROJECTED ENVIRONMENTAL IMPACTS & MITIGATION ANALYSIS
BASELINE SOCIAL & ECONOMIC CONDITIONS	SITE/DESIGN INFORMATION NECESSARY FOR ASSESSMENT OF TRANSPORTATION IMPACTS	PROJECTED SOCIAL & ECONOMIC IMPACTS & MITIGATION ANALYSIS
BASELINE TRANSPORTATION CONDITIONS	SITE/DESIGN INFORMATION NEEDED FOR ASSESSMENT OF TRANSPORTATION IMPACTS	PROJECTED TRANSPORTATION IMPACTS & MITIGATION ANALYSIS
		IMPACTS TO ENVIRONMENT AND RISKS TO PUBLIC HEALTH AND SAFETY
		HIGHER LEVEL FINDINGS ON TECHNICAL GUIDELINES

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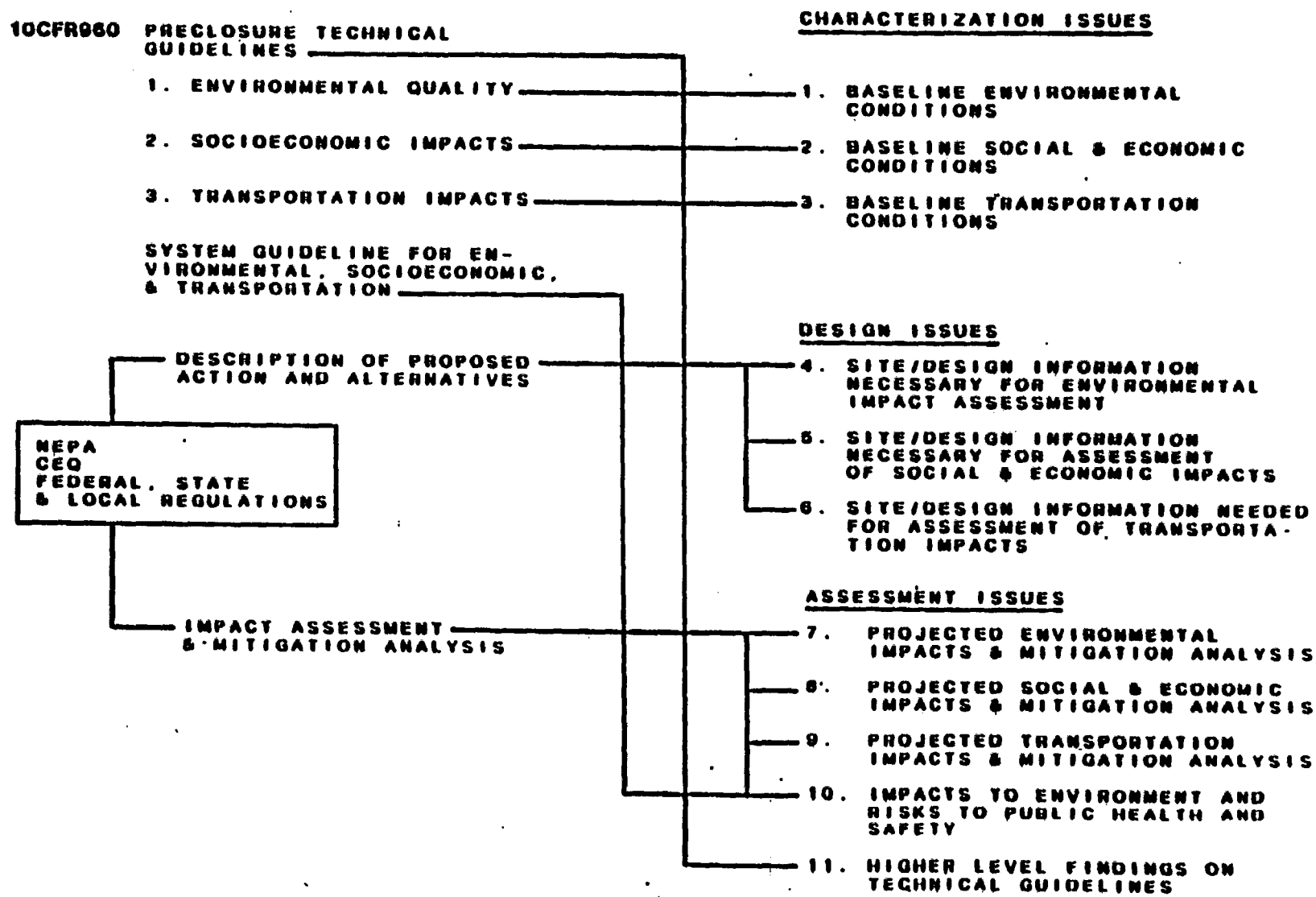
KEY ISSUE 3

PRECLOSURE ENVIRONMENTAL, SOCIOECONOMIC, & TRANSPORTATION IMPACTS



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OCRWM — Nevada Nuclear Waste Storage Investigations PROJECT — YUCCA MOUNTAIN — OGR

KEY ISSUE 4

COST EFFECTIVE WITH REASONABLY AVAILABLE TECHNOLOGY

10CFR60 40CFR191

CHARACTERIZATION ISSUES 10CFR960	DESIGN ISSUES 10CFR960, 10CFR60	PERFORMANCE ISSUES 10CFR960, 10CFR60
SURFACE CHARACTERISTICS AND CONDITIONS	AVAILABILITY OF TECHNOLOGY FOR WASTE PACKAGE DESIGN	ABILITY TO MAINTAIN OPTION OF WASTE RETRIEVAL
HOST ROCK CHARACTERISTICS	AVAILABILITY OF TECHNOLOGY FOR REPOSITORY DESIGN	HIGHER LEVEL FINDINGS ON TECHNICAL GUIDELINES
HYDROLOGIC CHARACTERISTICS AND CONDITIONS	TOTAL SYSTEM COST-EFFECTIVENESS	
TECTONIC AND IGNEOUS ACTIVITY	INDUSTRIAL SAFETY REQUIREMENTS	

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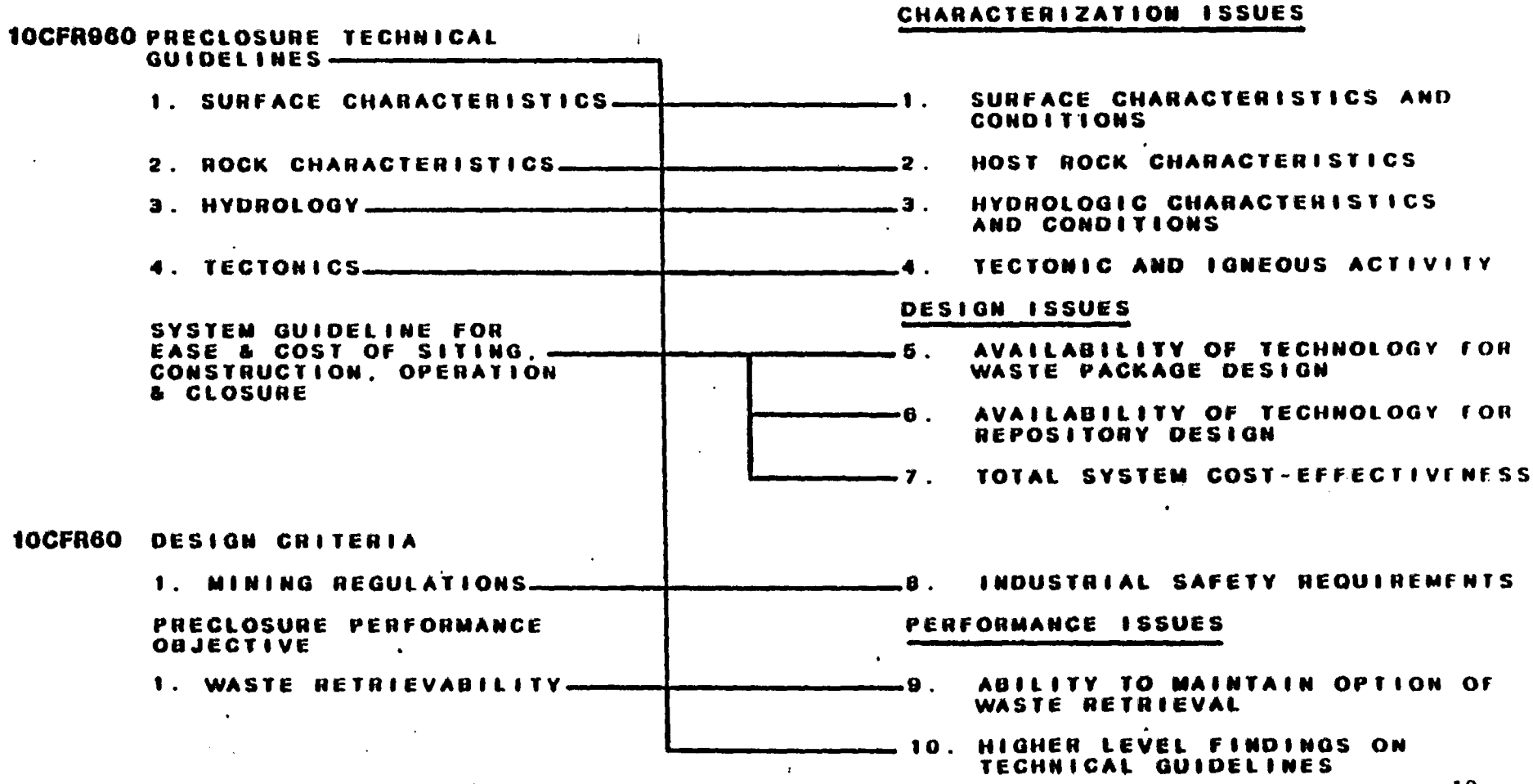
OCRWM OGR — Nevada Nuclear Waste Storage Investigations PROJECT

KEY ISSUE 4

COST EFFECTIVE WITH REASONABLY AVAILABLE TECHNOLOGY



DRAFT 5/15/85

KEY ISSUE 1: Will the geologic repository at the Yucca Mountain site, including multiple natural and engineered barriers, isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 10 CFR Part 60 and 40 CFR Part 191?

CHARACTERIZATION ISSUES

ISSUE 1.1: What are the present and expected characteristics of the geohydrologic setting that must be known to determine compatibility with containment and isolation?

ISSUE 1.2: What are the present and expected geochemical characteristics that must be known to determine compatibility with containment and isolation?

ISSUE 1.3: What are the present and expected characteristics of the host rock and surrounding units that must be known to determine compatibility with containment and isolation?

ISSUE 1.4: What are the future climatic conditions that must be known to determine if radionuclide releases will be greater than those allowed by regulations?

ISSUE 1.5: What are the future erosional processes and rates that must be known to determine if releases are likely to be greater than those allowed by regulations?

ISSUE 1.6: What characteristics of rock dissolution within the geologic setting must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?

ISSUE 1.7: What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?

ISSUE 1.8: What are the natural resources at or near the site that could cause human interference activities that could lead to radionuclide releases greater than those allowed by regulations?

DESIGN ISSUES

ISSUE 1.9: What are the characteristics and configuration of the waste package that must be known to show that interactions with the emplacement environment do not compromise the function of the waste packages, the performance of the underground facility, or the geologic setting?

ISSUE 1.10: What characteristics and configurations of the underground facility contribute to containment and isolation?

ISSUE 1.11: What are the characteristics and configurations of seals for shafts, drifts, and boreholes that will not compromise containment and isolation?

PERFORMANCE ISSUES

ISSUE 1.12: What are the magnitudes and the extent of the effects of the repository on site characteristics?

ISSUE 1.13: Will the waste package provide substantially complete containment for at least 300-1000 years?

ISSUE 1.14: Will the engineered barrier system meet the performance objective for radionuclide release rates?

ISSUE 1.15: Is the pre-waste-emplacement ground-water travel time at least 1000 years along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment?

ISSUE 1.16: Will the projected range of radionuclide releases to the accessible environment meet the system performance objective?

ISSUE 1.17: What are the effects of favorable and potentially adverse conditions on repository performance?

ISSUE 1.18: Can the higher level findings that are required by 10 CFR Part 960 for the postclosure technical guidelines be made?

KEY ISSUE 2: Will projected radiological exposures of the general public and repository workers, and releases of radioactive materials to restricted and unrestricted areas during repository operation and closure at the Yucca Mountain site meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, and 40 CFR Part 191?

CHARACTERIZATION ISSUES

ISSUE 2.1: What information on population density and distribution in the vicinity of the site is necessary to determine compliance with preclosure radiological safety requirements?

ISSUE 2.2: What information on the status of land ownership and surface and subsurface rights to land and minerals in the vicinity of the site, is necessary to determine compliance with preclosure radiological safety requirements?

ISSUE 2.3: What are the prevailing meteorological conditions that must be known to determine compliance with preclosure radiological safety requirements?

ISSUE 2.4: What are the characteristics of offsite installations and operations that must be known to determine compliance with preclosure radiological safety requirements?

DESIGN ISSUES

ISSUE 2.5: Will the waste packages maintain containment during handling, emplacement, and retrieval?

ISSUE 2.6: What features and operating procedures of the geologic repository ensure radiological protection of the environment, the public and the workers?

PERFORMANCE ISSUES

ISSUE 2.7: Will the radiation exposures and levels in, and releases of radioactive materials to, restricted and unrestricted areas be less than the allowable limits?

ISSUE 2.8: Can the higher level findings that are required by 10 CFR Part 960 for the preclosure technical guidelines related to radiological safety be made?

KEY ISSUE 3: Can the repository and its support facilities be sited, constructed, operated, closed, and decommissioned so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?

CHARACTERIZATION ISSUES

ISSUE 3.1: What are the present and projected environmental conditions considered sufficient to assess environmental impacts?

ISSUE 3.2: What are the present and projected social and economic conditions considered sufficient to assess social and economic impacts?

ISSUE 3.3: What are the present and projected transportation conditions considered sufficient to assess transportation impacts?

DESIGN ISSUES

ISSUE 3.4: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess environmental impacts and risks to the public health and safety?

ISSUE 3.5: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess social and economic impacts to the affected area?

ISSUE 3.6: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess transportation impacts to the affected area?

ASSESSMENT ISSUES

ISSUE 3.7: What are the projected environmental impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.8: What are the projected social and economic impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.9: What are the projected transportation-related impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.10: What are the projected significant environmental impacts and risks to public health and safety that cannot be mitigated or otherwise avoided?

ISSUE 3.11: Can the higher level findings that are required by 10 CFR Part 960 for the preclosure technical guidelines related to environmental quality and public health and safety be made?

KEY ISSUE 4: Will repository construction, operation (including retrieval), closure, and decommissioning be feasible at the Yucca Mountain site on the basis of reasonably available technology and will the associated costs be reasonable?

CHARACTERIZATION ISSUES

ISSUE 4.1: What are the surface characteristics and conditions that must be known to determine if construction, operation, closure, and decommissioning of the repository are feasible?

ISSUE 4.2: What are the characteristics of the host rock and surrounding units that must be known to determine if construction, operation, and closure of a repository are feasible?

ISSUE 4.3: What are the hydrologic characteristics and conditions that must be known to determine if construction, operation, closure and decommissioning of a repository are feasible?

ISSUE 4.4: What are the expected tectonic phenomena and igneous activity that must be known to determine if repository construction, operation, closure, and decommissioning are feasible?

DESIGN ISSUES

ISSUE 4.5: Can the waste packages be produced with reasonably available technology?

ISSUE 4.6: Will the design and operating procedures of the repository ensure non-radiological health and safety?

ISSUE 4.7: Can the repository be constructed, operated, closed, and decommissioned with reasonably available technology?

ISSUE 4.8: Will the repository system be cost-effective?

PERFORMANCE ISSUES

ISSUE 4.9: Will the design of the repository system preserve the option of waste retrieval?

ISSUE 4.10: Can the higher level findings that are required by 10 CFR 960 for the preclosure technical guidelines related to ease and cost of siting, construction, operation and closure be made?

DRAFT 5/15/85

KEY ISSUE 1: Will the geologic repository at the Yucca Mountain site, including multiple natural and engineered barriers, isolate the radioactive waste from the accessible environment after closure in accordance with the requirements set forth in 10 CFR Part 60 and 40 CFR Part 191?

CHARACTERIZATION ISSUES

ISSUE 1.1: What are the present and expected characteristics of the geohydrologic setting that must be known to determine compatibility with containment and isolation?

1.1.1 Description of the hydrogeology.

1.1.2 Description of the regional hydrologic system.

1.1.3 Hydrologic characteristics at the site.

1.1.4 Conceptual models of ground-water flow in the unsaturated zone within the boundaries of the accessible environment.

1.1.5 Conceptual models of ground-water flow in the saturated zone within the boundaries of the accessible environment.

1.1.6 Flow paths, fluxes, and velocities of water and gases in the unsaturated zone.

1.1.7 Flow paths, fluxes, and velocities of water in the saturated zone.

ISSUE 1.2: What are the present and expected geochemical characteristics that must be known to determine compatibility with containment and isolation?

1.2.1 Water chemistry within the potential emplacement horizon and along potential flow paths.

1.2.2 Mineralogy, petrology, and rock chemistry within the potential emplacement horizon and along potential flow paths.

1.2.3 Stability of minerals and glasses at the site.

1.2.4 Radionuclide retardation by sorption processes along flow paths to the accessible environment.

1.2.5 Radionuclide retardation by precipitation processes along flow paths to the accessible environment.

1.2.6 Radionuclide retardation by dispersive/diffusive/advective transport processes along flow paths to the accessible environment.

1.2.7 Radionuclide retardation by all processes along flow paths to the accessible environment.

ISSUE 1.3: What are the present and expected characteristics of the host rock and surrounding units that must be known to determine compatibility with containment and isolation?

1.3.1 Stratigraphy necessary to locate the underground facility.

1.3.2 Locations and characteristics of structural features.

1.3.3 Spatial distribution of thermal and mechanical properties.

1.3.4 Spatial distribution of ambient stress and thermal conditions.

ISSUE 1.4: What are the future climatic conditions that must be known to determine if radionuclide releases will be greater than those allowed by regulations?

1.4.1 Ranges of future climatic conditions.

1.4.2 Potential effects of future climatic conditions on hydrologic, geochemical, and rock characteristics.

ISSUE 1.5: What are the future erosional processes and rates that must be known to determine if releases are likely to be greater than those allowed by regulations?

1.5.1 Present locations and rates of surface erosion.

1.5.2 Potential effects of future climatic conditions on locations and rates of erosion.

1.5.3 Potential effects of tectonic activity on locations and rates of erosion.

1.5.4 Potential effects of erosion on hydrologic, geochemical, and rock characteristics.

ISSUE 1.6: What characteristics of rock dissolution within the geologic setting must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?

1.6.1 Rates of dissolution of crystalline and non-crystalline components in tuff.

ISSUE 1.7: What characteristics of future tectonic processes or events must be known to determine if radionuclide releases are likely to be greater than those allowed by regulations?

1.7.1 Rates and magnitudes of potential igneous activity.

1.7.2 Rates and magnitudes of potential fault movement, uplift, and seismic activity.

1.7.3 Potential effects of igneous and tectonic activity on hydrologic, geochemical, and rock characteristics.

ISSUE 1.8: What are the natural resources at or near the site that could cause human interference activities that could lead to radionuclide releases greater than those allowed by regulations?

1.8.1 Natural phenomena and human activities that might degrade surface markers and monuments.

1.8.2 Present and future value of energy, mineral, land, and ground-water resources.

1.8.3 Potential effects of exploiting natural resources on hydrologic, geochemical, and rock characteristics.

DESIGN ISSUES

ISSUE 1.9: What are the characteristics and configuration of the waste package that must be known to show that interactions with the emplacement environment do not compromise the function of the waste packages, the performance of the underground facility, or the geologic setting?

1.9.1 Definition of the near field environment of the waste packages following emplacement.

1.9.2 Waste package design features that affect the performance of the containment barrier.

1.9.3 Material properties for the containment barrier and estimates of the rates and mechanisms of containment-barrier degradation in the repository environment.

1.9.4 Waste package design features that affect the rate of radionuclide release.

1.9.5 Material properties of the waste forms and estimates of the rate of radionuclide release from the waste forms after the containment barrier is breached.

1.9.6 Reference waste package designs.

ISSUE 1.10: What characteristics and configurations of the underground facility contribute to containment and isolation?

1.10.1 Site characterization information needed for design.

1.10.2 Characteristics of waste package needed for design of the underground facility.

1.10.3 Design concepts for orientation, geometry, layout, and depth of the underground facility including flexibility to accommodate site specific conditions.

1.10.4 Design concepts for design of engineered barriers that are part of the underground facility.

1.10.5 Impacts of excavation methods on containment and isolation.

1.10.6 Predicted thermal and thermomechanical response of the host rock, surrounding strata, and groundwater system.

1.10.7 Reference postclosure underground facility designs.

ISSUE 1.11: What are the characteristics and configurations of seals for shafts, drifts, and boreholes that will not compromise containment and isolation?

1.11.1 Site, waste package, and underground facility information needed for design of seals and their placement methods.

1.11.2 Materials and characteristics for seals for shafts, drifts, and boreholes.

1.11.3 Placement methods for seals for shafts, drifts, and boreholes.

1.11.4 Reference design of seals for shafts and boreholes.

PERFORMANCE ISSUES

ISSUE 1.12: What are the magnitudes and the extent of the effects of the repository on site characteristics?

1.12.1 Effects on the geohydrologic, geochemical, and rock characteristics.

1.12.2 Boundaries of the disturbed zone.

ISSUE 1.13: Will the waste package provide substantially complete containment for at least 300-1000 years?

1.13.1 Site information needed to assess the performance of the containment barrier.

1.13.2 Scenarios for breaching the reference design waste packages.

1.13.3 Calculational models to predict the time to loss of containment and the ensuing time-dependent degradation of the containment barrier.

1.13.4 Determination of the time to loss of substantially complete containment of the reference design waste packages for both anticipated and unanticipated processes and events.

ISSUE 1.14: Will the engineered barrier system meet the performance objective for radionuclide release rates?

1.14.1 Site information needed to calculate the release rates from the engineered barrier system.

1.14.2 Boundaries of the reference engineered barrier system.

1.14.3 Scenarios for release of radionuclides from the reference engineered barrier system.

1.14.4 Calculational models to predict the release rates of radionuclides from the engineered barrier system.

1.14.5 Determination of the release rates from the engineered barrier system assuming both anticipated and unanticipated processes and events.

ISSUE 1.15: Is the pre-waste-emplacement ground-water travel time at least 1000 years along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment?

1.15.1 Site information needed to identify the fastest path of likely radionuclide travel and to calculate the ground-water travel time along that path.

1.15.2 Description of the paths from the disturbed zone to the accessible environment.

1.15.3 Calculational models to predict ground-water travel times in the unsaturated and saturated zones.

1.15.4 Identification of the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment.

1.15.5 Determination of the pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment.

ISSUE 1.16: Will the projected range of radionuclide releases to the accessible environment meet the system performance objective?

1.16.1 Site information needed to calculate the releases of radionuclides to the accessible environment.

1.16.2 Design concepts for the repository system that may reduce or delay the releases of radionuclides to the accessible environment.

1.16.3 Representative release scenarios that address both anticipated and unanticipated conditions.

1.16.4 Calculational models to predict radionuclide releases to the accessible environment.

1.16.5 Determination of the radionuclide releases to the accessible environment associated with representative scenarios.

1.16.6 Probabilistic estimates of the radionuclide releases to the accessible environment considering anticipated and unanticipated scenarios.

ISSUE 1.17: What are the effects of favorable and potentially adverse conditions on repository performance?

1.17.1 Identification of favorable and potentially adverse conditions at the site.

1.17.2 Potential effects of favorable and potentially adverse conditions on repository performance.

ISSUE 1.18: Can the higher level findings that are required by 10 CFR Part 960 for the postclosure technical guidelines be made?

1.18.1 Determination that the site is not disqualified and is not likely to be disqualified for each of the disqualifying conditions.

1.18.2 Determination that the site meets the qualifying conditions and is likely to continue to meet the qualifying conditions.

KEY ISSUE 2: Will projected radiological exposures of the general public and repository workers, and releases of radioactive materials to restricted and unrestricted areas during repository operation and closure at the Yucca Mountain site meet applicable safety requirements set forth in 10 CFR Part 20, 10 CFR Part 60, and 40 CFR Part 191?

CHARACTERIZATION ISSUES

ISSUE 2.1: What information on population density and distribution in the vicinity of the site is necessary to determine compliance with preclosure radiological safety requirements?

2.1.1 Resident and non-resident population density and distribution, spatial growth patterns, and population growth forecasts.

ISSUE 2.2: What information on the status of land ownership and surface and subsurface rights to land and minerals in the vicinity of the site is necessary to determine compliance with preclosure radiological safety requirements?

2.2.1 Present land ownership and control.

2.2.2 Surface and subsurface mineral and water rights.

2.2.3 Land ownership actions to be taken to control site access.

ISSUE 2.3: What are the prevailing meteorological conditions that must be known to determine compliance with preclosure radiological safety requirements?

2.3.1 Meteorological conditions in the vicinity of the site.

2.3.2 Atmospheric and meteorological phenomena at potential locations of surface facilities.

2.3.3 Location of population centers relative to wind patterns in the general region of the site.

2.3.4 Potential extreme weather phenomena and their recurrence intervals.

ISSUE 2.4: What are the characteristics of offsite installations and operations that must be known to determine compliance with preclosure radiological safety requirements?

2.4.1 Nearby industrial, transportation, and military installations and operations (nuclear and nonnuclear).

2.4.2 Potential impacts of nearby installations and operations.

DESIGN ISSUES

ISSUE 2.5: Will the waste packages maintain containment during handling, emplacement, and retrieval?

2.5.1 Description of the ranges of conditions imposed on the waste package for credible scenarios resulting from the reference repository facility operations.

2.5.2 Features of the reference waste package designs that affect pre-closure containment.

2.5.3 Determination that the waste packages maintain containment.

ISSUE 2.6: What features and operating procedures of the geologic repository ensure radiological protection of the environment, the public and the workers?

2.6.1 Site information needed for design.

2.6.2 Characteristics of waste and waste packages needed for repository design.

2.6.3 Identification and description of safety-related items, radiation zones, and normal and accident conditions, including disruptive events.

2.6.4 Means to limit worker internal and external radiation exposures, including ventilation, time, distance, and shielding.

2.6.5 Means to monitor and control radiation exposure conditions, including means to respond to emergencies.

2.6.6 Means to assure nuclear criticality safety.

2.6.7 Means to manage onsite generated radioactive waste and to decommission surface facilities.

2.6.8 Means of complying with mining regulations to ensure radiological safety.

PERFORMANCE ISSUES

ISSUE 2.7: Will the radiation exposures and levels in, and releases of radioactive materials to, restricted and unrestricted areas be less than the allowable limits?

2.7.1 Radiation environment in surface and subsurface facilities due to natural radioactivity.

2.7.2 Projected releases of radioactive material from the repository to restricted and unrestricted areas under normal and accident conditions.

2.7.3 Determination that projected worker exposures and exposure conditions under normal and accident conditions meet applicable requirements.

2.7.4 Determination that public radiation exposures resulting from the releases of radioactive material from the repository combined with exposures from offsite installations and operations meet applicable requirements.

ISSUE 2.8: Can the higher level findings that are required by 10 CFR Part 960 for the preclosure technical guidelines related to radiological safety be made?

2.8.1 Determination that the site is not disqualified and is not likely to be disqualified for each of the disqualifying conditions.

2.8.2 Determination that the site meets the qualifying conditions and is likely to continue to meet the qualifying conditions.

KEY ISSUE 3: Can the repository and its support facilities be sited, constructed, operated, closed, and decommissioned so that the quality of the environment will be protected and waste-transportation operations can be conducted without causing unacceptable risks to public health or safety?

(NOTE: INFORMATION NEEDS CURRENTLY UNDER PREPARATION)

CHARACTERIZATION ISSUES

ISSUE 3.1: What are the present and projected environmental conditions considered sufficient to assess environmental impacts?

ISSUE 3.2: What are the present and projected social and economic conditions considered sufficient to assess social and economic impacts?

ISSUE 3.3: What are the present and projected transportation conditions considered sufficient to assess transportation impacts?

DESIGN ISSUES

ISSUE 3.4: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess environmental impacts and risks to the public health and safety?

ISSUE 3.5: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess social and economic impacts to the affected area?

ISSUE 3.6: What are the characteristics of the site, proposed facilities, and operating procedures and activities considered sufficient to assess transportation impacts to the affected area?

ASSESSMENT ISSUES

ISSUE 3.7: What are the projected environmental impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.8: What are the projected social and economic impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.9: What are the projected transportation-related impacts and what mitigation activities will be employed to avoid or reduce these impacts?

ISSUE 3.10: What are the projected significant environmental impacts and risks to public health and safety that cannot be mitigated or otherwise avoided?

ISSUE 3.11: Can the higher level findings that are required by 10 CFR Part 960 for the preclosure technical guidelines related to environmental quality and public health and safety be made?

KEY ISSUE 4: Will repository construction, operation (including retrieval), closure, and decommissioning be feasible at the Yucca Mountain site on the basis of reasonably available technology and will the associated costs be reasonable?

CHARACTERIZATION ISSUES

ISSUE 4.1: What are the surface characteristics and conditions that must be known to determine if construction, operation, closure, and decommissioning of the repository are feasible?

4.1.1 Topographic characteristics of potential locations of surface facilities.

4.1.2 Soil and bedrock properties of potential locations of surface facilities.

4.1.3 Local meteorological conditions at potential locations of surface facilities.

4.1.4 Characteristics of the surface water systems in the vicinity of the site.

ISSUE 4.2: What are the characteristics of the host rock and surrounding units that must be known to determine if construction, operation, and closure of a repository are feasible?

4.2.1 Stratigraphy necessary to locate the underground facility..

4.2.2 Locations and characteristics of structural features.

4.2.3 Spatial distribution of thermal and mechanical properties.

4.2.4 Spatial distribution of ambient stress and thermal conditions.

ISSUE 4.3: What are the hydrologic characteristics and conditions that must be known to determine if construction, operation, closure and decommissioning of a repository are feasible?

4.3.1 Flood recurrence intervals and levels at potential locations of surface facilities.

4.3.2 Location of adequate water supplies.

4.3.3 Ground-water conditions within and above the potential host rock.

ISSUE 4.4: What are the expected tectonic phenomena and igneous activity that must be known to determine if repository construction, operation, closure, and decommissioning are feasible?

4.4.1 Rates and magnitudes of potential igneous activity that could have an impact at the site.

4.4.2 Potential fault movements at the site.

4.4.3 Ground-motion at the site from potential man-made or natural seismic events.

DESIGN ISSUES

ISSUE 4.5: Can the waste packages be produced with reasonably available technology?

4.5.1 Determination that the waste packages can be produced with reasonably available technology.

ISSUE 4.6: Will the design and operating procedures of the repository ensure non-radiological health and safety?

4.6.1 Site information needed for design.

4.6.2 Potential non-radiological hazards to personnel.

4.6.3 Design measures for avoiding or mitigating hazards to personnel.

ISSUE 4.7: Can the repository be constructed, operated, closed, and decommissioned with reasonably available technology?

4.7.1 Site information needed for design.

4.7.2 Characteristics and quantities of waste and waste packages needed for design.

4.7.3 Potential impacts of surface conditions on design.

4.7.4 Potential impacts of rock characteristics on design.

4.7.5 Potential impacts of hydrologic characteristics on design.

4.7.6 Potential impacts of tectonic activity on design.

4.7.7 Determination that the surface facilities can be constructed, operated, closed, and decommissioned with reasonably available technology.

4.7.8 Determination that the underground facilities can be constructed, operated, closed, and decommissioned with reasonably available technology.

4.7.9 Determination that the seals for shafts, drifts, and boreholes can be emplaced with reasonably available technology.

4.7.10 Determination that the repository will meet the requirements for permanent closure.

ISSUE 4.8: Will the repository system be cost-effective?

4.8.1 Estimates of the cost of reference and alternate waste packages.

4.8.2 Estimates of the cost of reference and alternate repository designs.

4.8.3 Life-cycle costs of the reference and alternate total system designs and assessment of their relative cost-effectiveness.

PERFORMANCE ISSUES

ISSUE 4.9: Will the design of the repository system preserve the option of waste retrieval?

4.9.1 Basis for allowing backfilling part or all of, or permanent closure of, the underground facility prior to the end of the period of retrievability.

4.9.2 Definition of a reasonable schedule for waste retrieval.

4.9.3 Basis upon which retrievability is assured for up to 50 years after waste emplacement operations are initiated.

4.9.4 Basis upon which a retrievability period less than 50 years is more appropriate and more acceptable.

4.9.5 Determination of the ability to retrieve all or part of the emplaced wastes.

ISSUE 4.10: Can the higher level findings that are required by 10 CFR 960 for the preclosure technical guidelines related to ease and cost of siting, construction, operation and closure be made?

4.10.1 Determination that the site is not disqualified and is not likely to be disqualified for each of the disqualifying conditions.

4.10.2 Determination that the site meets the qualifying conditions and is likely to continue to meet the qualifying conditions.

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
KEY ISSUE 1: POSTCLOSURE PERFORMANCE						
Characterization Issues: (postclosure siting guidelines)						
Issue 1.1	Geohydrology			83121		
1.1.1	SCP	USGS		831211	ESTP/SBTP	
1.1.2	SCP	USGS		831212	SBTP	
1.1.3	SCP	USGS		831213	ESTP/SBTP	
1.1.4	SCP	USGS		831214	SCP	
1.1.5	SCP	USGS		831215	SCP	
1.1.6	SCP	USGS		831216	ESTP	
1.1.7	SCP	USGS		831217	SCP	
Issue 1.2	Geochemistry			83122		
1.2.1	SCP	LANL		831221	ESTP/SBTP	
1.2.2	SCP	LANL		831222	ESTP/SBTP	
1.2.3	SCP	LANL		831223	SBTP	
1.2.4	SCP	LANL		831224	ESTP/SBTP	
1.2.5	SCP	LANL		831225	SBTP	
1.2.6	SCP	LANL		831226	ESTP/SBTP	
1.2.7	SCP	LANL		831227	SCP	
Issue 1.3	Rock Characteristics			83123		
1.3.1	SCP	USGS		831231	ESTP/SBTP	
1.3.2	SCP	USGS		831232	ESTP/SBTP	
1.3.3	SCP	SNL	Nimick	831233	ESTP/SBTP	
1.3.4	SCP	USGS		831234	ESTP/SBTP	
Issue 1.4	Climatic Changes			83124		
1.4.1	SCP	SAIC	McCann	831241	MMP/SBTP	Bentley, USGS
1.4.2	SCP	SAIC/SNL	McCann	831242	SCP	Tillerson, SNL
Issue 1.5	Erosion			83125		
1.5.1	SCP	USGS		831251	SBTP	
1.5.2	SCP	USGS		831252	SCP	
1.5.3	SCP	USGS		831253	SCP	
1.5.4	SCP	USGS		831254	SCP	Tillerson, SNL
Issue 1.6	Dissolution			83126		
1.6.1	SCP	LANL		831261	SBTP	

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INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
Issue 1.7	Tectonics			83127		
1.7.1	SCP	LANL		831271	SBTP	
1.7.2	SCP	USGS		831272	SBTP	
1.7.3	SCP	USGS		831273	SCP	Tillerson, SNL
Issue 1.8	Natural Resources			83128		
1.8.1	SCP	SAIC	Oakes	831281	SFAP	
1.8.2	SCP	SAIC	Oakes	831282	SCP	
1.8.3	SCP	SAIC	Oakes	831283	SCP	Tillerson, SNL
Design Issues: (postclosure design criteria)						
Issue 1.9	Waste Package Design					
1.9.1	SCP	LLNL			ESTP	
1.9.2	SCP	LLNL			SCP	
1.9.3	SCP	LLNL			SCP	
1.9.4	SCP	LLNL			SCP	
1.9.5	SCP	LLNL			SCP	
1.9.6	SCP	LLNL			SCP	
Issue 1.10	Repository Underground Facility			83225		
1.10.1	SCP	SNL	Mansure	832251	RDP	
1.10.2	SCP	SNL/LLNL	Stinebaugh	832252	RDP	
1.10.3	SCP	SNL	Mansure	832253	RDP	
1.10.4	SCP	SNL	Fernandez	832254	RDP	
1.10.5	SCP	SNL	Mansure	832255	RDP	
1.10.6	SCP	SNL	Mansure	832256	RDP	
1.10.7	SCP	SNL	Stinebaugh	832257	RDP	
Issue 1.11	Seals Design			83325		
1.11.1	SCP	SNL	Fernandez	833251	RSP	
1.11.2	SCP	SNL	Fernandez	833252	RSP	
1.11.3	SCP	SNL	Fernandez	833253	RSP	
1.11.4	SCP	SNL	Fernandez	833254	RSP	
Performance Issues:						
Issue 1.12	Effects of Repository on Site			83521		
1.12.1	SCP	SNL	Hayden	835211	PAP	Braithwaite
1.12.2	SCP	SNL	Braithwaite	835212	PAP	Langkopf

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INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
Issue 1.13	Waste Package Performance			83522		
1.13.1	SCP	LLNL		835221	SCP	
1.13.2	SCP	LLNL		835222	SCP	
1.13.3	SCP	LLNL		835223	SCP	
1.13.4	SCP	LLNL		835224	SCP	
Issue 1.14	Engineered Barrier Performance			83523		
1.14.1	SCP	LLNL		835231	PAP	SNL
1.14.2	SCP	LLNL		835232	PAP	SNL
1.14.3	SCP	LLNL		835233	PAP	SNL
1.14.4	SCP	LLNL		835234	PAP	SNL
1.14.5	SCP	LLNL/SNL		835235	PAP	SNL
Issue 1.15	Ground-water Travel Time			83524		
1.15.1	SCP	SNL	Hayden	835241	PAP	
1.15.2	SCP	SNL	Klavetter	835242	PAP	Lin, SNL
1.15.3	SCP	SNL	Hayden	835243	PAP	
1.15.4	SCP	SNL	Klavetter	835244	PAP	Lin, SNL
1.15.5	SCP	SNL	Klavetter	835245	PAP	Lin, SNL
Issue 1.16	Radionuclide Releases			83525		
1.16.1	SCP	SNL	Klavetter	835251	PAP	
1.16.2	SCP	SNL	Tierney	835252	PAP	Fernandez, SNL
1.16.3	SCP	SNL	Tierney	835253	PAP	
1.16.4	SCP	SNL	Tierney	835254	PAP	Peters, SNL
1.16.5	SCP	SNL	Tierney	835255	PAP	
1.16.6	SCP	SNL	Tierney	835256	PAP	Peters, SNL
Issue 1.17	Effects of Favorable and Potentially Adverse Conditions			83526		
1.17.1	SCP	USGS		835261	PAP	
1.17.2	SCP	SNL	Tierney	835262	PAP	
Issue 1.18	Higher Level Findings			83527		
1.18.1	SCP	SNL	Hayden	835271		
1.18.2	SCP	SNL	Hayden	835272		

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
KEY ISSUE 2 PRECLOSURE RADIOLOGICAL SAFETY						
Characterization Issues: (preclosure technical guidelines)						
Issue 2.1 Population Density and Distribution						
2.1.1						
Issue 2.2 Land Ownership						
2.2.1						
2.2.2						
2.2.3						
Issue 2.3 Meteorological Conditions						
2.3.1	ECP	SAIC	Cover			MMP
2.3.2	ECP	SAIC	Cover			MMP
2.3.3	ECP	SAIC	Cover			MMP
2.3.4	ECP	SAIC	Cover			MMP
Issue 2.4 Offsite Installation and Operations						
2.4.1						
2.4.2						
Design Issues: (preclosure design criteria)						
Issue 2.5 Waste Package Design						
2.5.1	SCP	LLNL				
2.5.2	SCP	LLNL				
2.5.3	SCP	LLNL				
Issue 2.6 Repository Operations Area				83231		
2.6.1	SCP/RDP	SNL	Shirley	832311		RDP
2.6.2	SCP/RDP	SNL	Shirley	832312		RDP
2.6.3	RDP	SNL				RDP
2.6.4	RDP	SNL				RDP
2.6.5	RDP	SNL				RDP
2.6.6	RDP	SNL				RDP
2.6.7	RDP	SNL				RDP
2.6.8	RDP	SNL				RDP
2.6.9	RDP	SNL				RDP

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
Performance Issues:						
Issue 2.7	Radiation Exposures and Releases			83531		
2.7.1	SCP	SNL	Shirley	835311	PAP	
2.7.2	SCP	SNL	Shirley	835312	PAP	
2.7.3	SCP	SNL	Shirley	835313	PAP	
Issue 2.8	Higher Level Findings					
2.8.1						
2.8.2						

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
KEY ISSUE 3 HEALTH, SAFETY, ENVIRONMENT, SOCIOECONOMIC, TRANSPORTATION						
Characterization Issues: (siting guidelines)						
Issue 3.1	Environmental Conditions					
3.1.1	ECP	SAIC	McCann		EPP	
3.1.2	ECP	SAIC	Brown		EFAP/MMP	EG&G
3.1.3	ECP	SAIC	Fasano		EFAP	
3.1.4	ECP	SAIC	McCann		EFAP	DRI
Issue 3.2	Socioeconomic Conditions					
3.2.1	ECP	SAIC	Alexander		SFAP	
3.2.2	ECP	SAIC	Alexander		SFAP	
3.2.3	ECP	SAIC	Alexander		SFAP	
Issue 3.3	Transportation Conditions					
3.3.1	ECP	SAIC	Scardino		TSP	
3.3.2	ECP	SAIC	Scardino		TSP	
3.3.3	ECP	SAIC	Scardino		TSP	
3.3.4	ECP	SAIC	Scardino		TSP	
3.3.5	ECP	SAIC	Scardino		TSP	
Design Issues:						
Issue 3.4	Repository Design Features Related to Environmental Quality					
3.4.1	RDP	SNL			RDP	
3.4.2	RDP	SNL			RDP	
Issue 3.5	Repository Design Features Related to Socioeconomic Impacts					
3.5.1	RDP	SNL			RDP	
3.5.2	RDP	SNL			RDP	
3.5.3	RDP	SNL			RDP	
3.5.4	RDP	SNL			RDP	
Issue 3.6	Repository Design Features Related to Impacts from Transportation					
3.6.1	RDP	SNL			RDP	
3.6.2	RDP	SNL			RDP	
3.6.3	RDP	SNL			RDP	
3.6.4	RDP	SNL			RDP	

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
Assessment Issues:						
Issue 3.7	Environmental Quality Impacts					
3.7.1	ECP	SAIC	Brown		EFAP	EG&G, DRI
3.7.2	ECP	SAIC	Brown		EFAP	EG&G, DRI
Issue 3.8	Socioeconomic Impacts					
3.8.1	ECP	SAIC	Alexander		SFAP	
3.8.2	ECP	SAIC	Alexander		SFAP	
Issue 3.9	Impacts from Transportation					
3.9.1	ECP	SAIC	Scardino		EFAP/TSP	
3.9.2	ECP	SAIC	Scardino		EFAP/TSP	

DRAFT
6-May-85

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
KEY ISSUE 4 PRECLOSURE PERFORMANCE						
Characterization Issues: (preclosure siting guidelines)						
Issue 4.1	Surface Characteristics			83131		
4.1.1	SCP	USGS		831311	SBTP	SNL
4.1.2	SCP	SNL	Neal	831312	SBTP	USGS
4.1.3	SCP	SAIC	McCann	831313	MMP	
4.1.4	SCP	USGS		831314	SBTP	SNL
Issue 4.2	Rock Characteristics			83132		
4.2.1	SCP	USGS		831321	ESTP/SBTP	Nimick, SNL
4.2.2	SCP	USGS		831322	ESTP/SBTP	Nimick, SNL
4.2.3	SCP	SNL	Nimick	831323	ESTP/SBTP	
4.2.4	SCP	USGS		831324	ESTP/SBTP	Nimick, SNL
Issue 4.3	Hydrology			83133		
4.3.1	SCP	SNL		831331	SBTP	USGS
4.3.2	SCP	USGS		831332	SBTP	Neal, SNL
4.3.3	SCP	USGS		831333	ESTP/SBTP	
Issue 4.4	Tectonics			83134		
4.4.1	SCP	LANL		831341	SBTP	Neal, SNL
4.4.2	SCP	USGS		831342	SBTP	Neal, SNL
4.4.3	SCP	USGS		831343	SBTP	Subra, SNL
Design Issues:						
Issue 4.5	Waste Package Technology					
4.5.1	SCP	LLNL			SCP	
Issue 4.6	Non-rad Health and Safety			83232		
4.6.1	SCP/RDP	SNL	Stinebaugh	832321		
4.6.2	RDP	SNL			RDP	
4.6.3	RDP	SNL			RDP	
Issue 4.7	Repository Designs			83233		
4.7.1	SCP/RDP	SNL	Subra	832331	RDP	
4.7.2	RDP	SNL			RDP	
4.7.3	SCP/RDP	SNL	Subra	832332	RDP	
4.7.4	SCP/RDP	SNL	Mansure	832333	RDP	
4.7.5	SCP/RDP	SNL	Subra	832334	RDP	
4.7.6	SCP/RDP	SNL	Subra	832335	RDP	

INFORMATION NEED ASSIGNMENTS

IN Number	Main Plan	Partic-ipant	Responsible Person	SCP Section #	Detailed Test in.	Support From
4.7.7	RDP	SNL			RDP	
4.7.8	RDP	SNL			RDP	
4.7.9	RDP	SNL			RDP	
4.7.10						
Issue 4.8	Repository Cost-effectiveness					
4.8.1	SCP	LLNL			SCP/RDP	
4.8.2	RDP	SNL			RDP	
4.8.3	RDP	SNL			RDP	
Performance Issues:						
Issue 4.9	Waste Retrieval			83532		
4.9.1	SCP	SNL	Flores	835321	PAP/RDP	
4.9.2	SCP	SNL	Flores	835322	PAP/RDP	
4.9.3	SCP	SNL	Flores	835323	PAP/RDP	
4.9.4	SCP	SNL	Flores	835324	PAP/RDP	
4.9.5	SCP	SNL	Flores	835325	PAP/RDP	
Issue 4.10	Higher Level Findings					
4.10.1						
4.10.2						

Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114-4100

MAY 31 1985

W. J. Purcell, Director, Office of Geologic Repositories, DOE/HQ (RW-20), FORSTL

NNWSI PROJECT WEEKLY HIGHLIGHTS FOR WEEK ENDING MAY 30, 1985

I. Issues Requiring Involvement of HQ or Other Projects

A. New Issues:

None to report.

B. Previously Reported Issues:

	Issue	Status	First Report Date
1.	Regarding March 18 letter to Purcell requesting support to resolve OCRWM position on transportation, a meeting or plan is required to clarify issues and document OCRWM policy positions.	Open	3/20/85
2.	Regarding March 19 letter to E. S. Burton - EA Briefings and Hearings - requested copy of documents generated as a result of "Roles and Responsibilities at Briefings" memo.	Open - Per ISGG Meeting 5/9-10, should be available 6/15.	3/14/85

II. Major Internal Concerns

None to report.

III. Significant Accomplishments (SA)/Information Items (II)

SA

None to report.

II.

A group of local news reporters was taken to the WIPP site near Carlsbad, New Mexico. On Monday, an almost full-page article appeared in the Las Vegas Review Journal describing the WIPP project, particularly as it applies to a high-level nuclear waste repository at Yucca Mountain. An inset article stated the State of Nevada's reaction to the tour and attempts to use WIPP as an analogy for an engineered repository in welded tuff.

Chris West (OPA) attended a committee meeting in Chicago on May 29 to help develop an Outreach plan and materials for the OGR projects.

Don Vieth was interviewed by Channel 10 (local educational television) for source material on the repository to be used in an interview with U.S. Senator Paul Laxalt; the show was aired on May 29.

Senate Bill 56 is pending in the Nevada Legislative which would move the State's Nuclear Waste Project Office away from the jurisdiction of the Governor to a newly formed Commission on Nuclear Projects. Under the current bill, the existing Nevada Nuclear Waste Project Office staff would work under the direction of a seven-member commission. The measure calls for two members of the commission to be appointed by the Governor; two by the Legislative Commission; and two to be appointed by the Governor. One of these individuals would be selected from a list of three names selected by the Nevada League of Cities and the other would be selected from a list of three names compiled by the Nevada Association of Counties. The six would appoint a seventh member from the area affected by the Project. The bill may be modified as it moves through the Legislative this week.

IV. Upcoming Events

1. Coordination Group Meetings

- o Tuesday-Thursday, June 25-27: Waste Package Coordination Group Meeting, Denver.

2. HQ Meetings

- o Monday-Tuesday, June 3-4: DOE Inspector General visit.
- o Wednesday-Thursday, June 5-6: OGR Budget Meeting, Washington, D.C.

3. Internal Project and DOE/NV Meetings

   - o Monday, June 3: SCP Management Group Meeting, Las Vegas.
   - o Tuesday, June 4: Don Vieth Meeting with USGS, Reston.
   - o Wednesday-Thursday, June 12-13: ESTPC Meeting, Los Alamos.
   - o Monday, June 17: SCP Management Group Meeting, Las Vegas.
   - o Tuesday, June 18: QA Software SOP Meeting, Las Vegas.
   - o Wednesday-Thursday, June 26-27: PM-TPO Meeting, Las Vegas (subject to change to June 27-28).

4. State and Public Interaction

   - o Thursday-Wednesday, June 13-19: USNCTT, New York (Don Vieth).
   - o Wednesday, June 26: Pine County Commissioners/Ely Town Meeting (Tentative).

5. NRC Interaction

   - o Tuesday-Wednesday, July 23-24: NRC/DOE Waste Package Meeting.

for Donald L. Vieth, Director
Waste Management Project Office

WMPO:DLV-1054

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Nevada Nuclear Waste Storage Investigations PROJECT

YUCCA MOUNTAIN

REGULATORY COMPLIANCE PRESENTATION

PM - TPO MEETING

MAY 29, 1985

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OCRWM — Nevada Nuclear Waste Storage Investigations PROJECT — YUCCA MOUNTAIN — OGR

NNWSI PROJECT - TPO MEETING
MAY 29, 1985

REGULATORY COMPLIANCE PRESENTATION AGENDA

o INTRODUCTION	J. SZYMANSKI
o REGULATORY FRAMEWORK	M. GLORA/M. J. WISE
o PAST NUCLEAR FACILITY LICENSING EXPERIENCE	DAVE TILLSON
o NRC PERSPECTIVE	PAUL PRESTHOLT
o KEY REGULATORY EVENTS	M. GLORA
o NNWSI PROJECT REGULATORY NEEDS AND STRATEGIES	M. GLORA

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OCRWM — Nevada Nuclear Waste Storage Investigations PROJECT — YUCCA MOUNTAIN — OGR

PRESENTATION APPROACH

1. STATEMENT OF THE PROBLEM
   - REGULATORY FRAMEWORK
   - PAST LICENSING EXPERIENCE
     - HANDLING OF GEOLOGIC CONCERNS
   - NRC PERSPECTIVE
   - REGULATORY EVENTS
2. SOLUTIONS
   - NEEDS
   - STRATEGIES

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Nevada Nuclear Waste Storage Investigations PROJECT

YUCCA MOUNTAIN

REGULATORY FRAMEWORK

REGULATORY FRAMEWORK

INTRODUCTION

- UNDERSTANDING OF THE "REGULATORY FRAMEWORK" IS ESSENTIAL TO DEVELOPING THE PROJECT STRATEGY FOR OBTAINING LICENSE.
  - WHAT IS NRC (REGULATOR'S) ROLE?
  - WHAT IS DOE (APPLICANT'S) ROLE?
  - HOW WILL DIFFERENT AGENCY REQUIREMENTS BE RECONCILED (DOE/NRC/EPA)?
  - HOW DOES THE PART 60 LICENSING PROCESS COMPARE TO PRODUCTION AND UTILIZATION (10 CFR 50) AND SNM (10 CFR 70)?
  - TO WHAT EXTENT WILL REACTOR EXPERIENCE/ PRECEDENT BE APPLIED?
  - WHAT NRC REGULATIONS ARE DIRECTLY APPLICABLE TO A REPOSITORY AND WHEN?

REGULATORY FRAMEWORK - CONTINUED

- WHAT ARE THE PROCEDURAL REQUIREMENTS FOR OBTAINING CA? LICENSE?
- HOW AND WHEN SHOULD OTHER INTERESTED PARTY'S CONCERNS BE ADDRESSED AND RESOLVED?

o PROJECT LICENSING STRATEGY SHOULD CONSIDER:
  - WHERE AND HOW DOE CAN EXERT INFLUENCE WITHIN BOUNDS OF THE LICENSING PROCEDURES
  - APPROACH TO EARLY "RESOLUTION" OF CONCERNS
  - AUTHORITIES AND RESPONSIBILITIES THROUGHOUT PRE AND POST APPLICATION PROCESS
  - APPLICATION/ADAPTATION OF PAST EXPERIENCE
  - NEGOTIATION NOT CONFRONTATION
o APPLICABLE NRC REGULATIONS
o LICENSING PROCESS
  - COMPARISON TO 10 CFR 50 AND 70 LICENSES
  - CA VS CP
  - AUTHORITY AND ENFORCEMENT

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APPLICABLE REGULATIONS

- DERIVED FROM IMPLEMENTING LEGISLATION
  - ATOMIC ENERGY ACT OF 1954
  - REORGANIZATION PLAN OF 1970 (EPA)
  - ENERGY REORGANIZATION ACT OF 1974
  - NWPA
- KEY IMPLEMENTING REGULATIONS
  - 10 CFR 960
  - 10 CFR 60
  - 40 CFR 191

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KEY REGULATION CHARACTERISTICS

- 10 CFR 960 - FINAL
  - APPLICABLE THROUGH SITE SELECTION BY DOE
  - GENERALLY CONSISTENT WITH 10 CFR 60 BUT IN MORE DETAIL
  - INTERPRETATIVE (IMPLEMENTATION) RESPONSIBILITY RESTS WITH DOE
  - NRC CONCURRENCE

- 40 CFR 191 - PROPOSED
  - APPLICABLE TO REPOSITORY OPERATION AND POST CLOSURE
  - DERIVED FROM EPA RESPONSIBILITY FOR GENERAL POPULATION PROTECTION
  - NRC RESPONSIBLE FOR IMPLEMENTATION
  - REDUNDANCY EXISTS WITH 10 CFR 60

KEY REGULATION CHARACTERISTICS (continued)

- 10 CFR 60 - FINAL
  - APPLICABLE TO SITE CHARACTERIZATION THROUGH REPOSITORY LICENSE TERMINATION (BASED ON REASONABLE ASSURANCE THAT CONTAINMENT AND ISOLATION REQUIREMENT WILL BE SATISFIED)
  - "FINAL" INTERPRETATION RESPONSIBILITY SOLELY WITH NRC
  - REQUIREMENTS BROADLY STATED IN MOST CASES
    - OPPORTUNITY FOR DOE TO INFLUENCE INTERPRETATION

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APPLICABLE NRC REGULATIONS

DIRECT CITATION OR AEA DERIVED

- 10 CFR 2 - RULES OF PRACTICE
- 10 CFR 7 - ADVISORY COMMITTEES (POSSIBLE APPLICABILITY)
- 10 CFR 19 - NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS
- 10 CFR 20 - STANDARDS FOR PROTECTION AGAINST RADIATION
- 10 CFR 21 - REPORTING OF DEFECTS AND NONCOMPLIANCE
- 10 CFR 50 - (APPENDIX B) QUALITY ASSURANCE REQUIREMENTS
- 10 CFR 51 - LICENSING AND REGULATORY POLICY AND PROCEDURES FOR ENVIRONMENTAL PROTECTION
- 10 CFR 60 - DISPOSAL OF HLW--

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10 CFR 2 - RULES OF PRACTICE FOR DOMESTIC LICENSING PROCEEDINGS

- PROCEDURES FOR ISSUANCE AND AMENDMENT OF A LICENSE
  - FILING
  - ADMINISTRATIVE REVIEW
  - HEARING ON APPLICATION
- PROCEDURES FOR MODIFICATION, SUSPENSION OR REVOCATION OF LICENSE
  - NOTICE OF VIOLATION
  - SHOW CAUSE ORDER
  - SETTLEMENT AND COMPROMISE
  - CIVIL PENALTIES
- RULES OF GENERAL APPLICABILITY
  - PROCEDURAL REQUIREMENTS FOR FILING, DOCKETING, NOTICES, INTERVENTION, ETC.
  - MOTIONS
  - DEPOSITIONS, DISCOVERY, ADMISSION, EVIDENCE
  - INITIAL AND FINAL DECISIONS
  - EXPARTE COMMUNICATIONS

10 CFR 19 - NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS

- POSTING OF NOTICES TO WORKERS
- INSTRUCTIONS TO WORKERS
- NOTIFICATION AND REPORTS TO INDIVIDUALS
- INSPECTIONS
  - PRESENCE OF REPRESENTATIVES OF LICENSEES AND WORKERS
  - CONSULTATION WITH WORKERS
  - REQUESTS BY WORKERS FOR INSPECTIONS
- EMPLOYEE PROTECTION (PROTECTED ACTIVITIES)

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Nevada Nuclear Waste Storage Investigations PROJECT

YUCCA MOUNTAIN

10 CFR 20 - STANDARDS FOR PROTECTION AGAINST RADIATION

- DOSE STANDARDS FOR INDIVIDUALS IN RESTRICTED AREAS
- PERMISSIBLE LEVELS OF RADIATION IN UNRESTRICTED AREAS
- PRECAUTIONARY PROCEDURES (SURVEYS, MONITORING, SIGNS, ETC.)
- WASTE DISPOSAL
- RECORDS, REPORTS, AND NOTIFICATION

10 CFR 60 REFERENCE: 60.111(A) - PROTECTION AGAINST RADIATION EXPOSURES AND RELEASES OF RADIOACTIVE MATERIAL

- PROPOSED RULE CHANGE BEFORE COMMISSION

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10 CFR 21 - REPORTING OF DEFECTS AND NONCOMPLIANCE

- REQUIRES NOTIFICATION TO NRC OF DEFECTS OR NONCOMPLIANCE WHICH COULD CREATE A SUBSTANTIAL SAFETY HAZARD
- APPLIES TO LICENSEE AND TO SUPPLIERS OF BASIC COMPONENTS*
- REQUIRES MAINTENANCE OF RECORDS RELATED TO DESIGN, MANUFACTURE, FABRICATION, PLACEMENT, ERECTION, INSTALLATION, MODIFICATION, INSPECTION OR TESTING OF ANY BASIC COMPONENT

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* REVISION TO INCLUDE CONTRACTORS AND "PRE-LICENSEES" BEING DISCUSSED

10 CFR 50, APPENDIX B - QUALITY ASSURANCE CRITERIA FOR NUCLEAR POWER PLANTS AND FUEL PROCESSING PLANTS

- 18 CRITERIA
- APPLIES TO SYSTEMS, STRUCTURES AND COMPONENTS IMPORTANT TO SAFETY
- APPLIES TO DESIGN AND CHARACTERIZATION OF BARRIERS IMPORTANT TO WASTE ISOLATION

10 CFR 60 REFERENCE: SUBPART G

10 CFR 51 - LICENSING AND REGULATORY POLICY AND PROCEDURES FOR ENVIRONMENTAL PROTECTION

- NRC EIS REQUIRED FOR LICENSING OF A REPOSITORY
- ER SUBMITTAL REQUIRED
  - ENVIRONMENTAL CONSIDERATIONS
  - COST-BENEFIT ANALYSIS
  - STATUS OF COMPLIANCE WITH FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS
- MODIFICATIONS PROPOSED IN ACCORD WITH NWPA

10 CFR 60 REFERENCE: 60.21(A) - CONTENT OF APPLICATION

10 CFR 60

PROCEDURAL PROVISIONS

SUBPART A - GENERAL PROVISIONS

SUBPART B - LICENSES

SUBPART C - PARTICIPATION BY STATE GOVERNMENTS AND INDIAN TRIBES

SUBPART D - RECORDS, REPORTS, TESTS AND INSPECTIONS

10 CFR 60

TECHNICAL PROVISIONS

SUBPART E - TECHNICAL CRITERIA

SUBPART F - PERFORMANCE CONFIRMATION PROGRAM

SUBPART G - QUALITY ASSURANCE

SUBPART H - TRAINING AND CERTIFICATION OF PERSONNEL

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PROPOSED 40 CFR 191 - ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR MANAGEMENT AND DISPOSAL OF SPENT NUCLEAR FUEL, HIGH-LEVEL AND TRANSURANIC RADIOACTIVE WASTES

SUBPART A - STANDARDS FOR MANAGEMENT AND STORAGE

- 25/75/25 STANDARD

SUBPART B - STANDARDS FOR DISPOSAL

- CONTAINMENT REQUIREMENTS
- GROUNDWATER PROTECTION REQUIREMENTS

10 CFR 60 REFERENCES: 60.112 - OVERALL SYSTEM PERFORMANCE OBJECTIVE; 60.111(A) - PROTECTION AGAINST RELEASES OF RADIOACTIVE MATERIAL

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OCRWM OGR Nevada Nuclear Waste Storage Investigations PROJECT — YUCCA MOUNTAIN

FORMS OF REGULATORY GUIDANCE

- REGULATIONS
- REGULATORY GUIDES
- TECHNICAL POSITIONS

FORMS OF REGULATORY GUIDANCE

REGULATIONS

- PROMULGATED TO EXERCISE AUTHORITY GRANTED BY CONGRESS
  - AGENCY INTERPRETATION OF CONGRESSIONAL INTENT
- USUALLY GENERAL IN NATURE
  - SET GOALS TO BE ACHIEVED BY LICENSEE
  - SUBJECT TO INTERPRETATION
- CARRY GREAT LEGAL WEIGHT
  - RESULT OF RULEMAKING PROCESS
  - COMMISSION VOTES APPROVAL

FORMS OF REGULATORY GUIDANCE

REGULATORY GUIDES

- STAFF INTERPRETATION OF REGULATION
- ESTABLISH AN ACCEPTABLE METHOD OR APPROACH FOR DEMONSTRATING COMPLIANCE
- USUALLY WRITTEN FOR GENERIC APPLICATION
- APPROVAL PROCESS LESS FORMAL AND LESS RIGOROUS THAN THAT OF REGULATIONS
- NUREGS SOMETIMES USED IN THIS CAPACITY

FORMS OF REGULATORY GUIDANCE

TECHNICAL POSITIONS

- STAFF INTERPRETATION OF REGULATION
- OFTEN MORE SPECIFIC THAN REGULATORY GUIDES
- APPROVAL PROCESS LESS FORMAL THAN THAT OF REGULATORY GUIDES

USE OF REGULATORY GUIDES DEVELOPED FOR OTHER APPLICATIONS

- JUDICIOUS USE OF EXISTING REGULATORY GUIDES IS ADVISABLE
- PROBLEMS WITH ADOPTION OR ADAPTATION
  - SPECIFIC DESIGNATION OF APPLICABILITY
  - UNAVAILABILITY OF INFORMATION TO DETERMINE APPLICABILITY
  - OVERLAP BETWEEN REGULATORY GUIDES BASED ON DIFFERING ASSESSMENTS OF CONSEQUENCE
  - CURRENT LACK OF KNOWLEDGE TO EVALUATE NEED, COST IMPACTS AND CONSEQUENCE
  - DEVELOPED FOR GENERIC APPLICATION

COMPARISON OF LICENSE REQUIREMENTS

10 CFR 50.10 LICENSE REQUIRED

(A) --NO PERSON SHALL--USE ANY PRODUCTION OR UTILIZATION FACILITY EXCEPT AS AUTHORIZED BY A LICENSE--

(B) --NO PERSON SHALL BEGIN CONSTRUCTION--UNTIL A CONSTRUCTION PERMIT HAS BEEN ISSUED

10 CFR 50.30 FILING OF APPLICATIONS

--EACH APPLICATION FOR A LICENSE, INCLUDING WHERE APPROPRIATE A CONSTRUCTION PERMIT--

10 CFR 60.3 LICENSE REQUIRED

(A) --DOE SHALL NOT RECEIVE OR POSSESS--EXCEPT AS AUTHORIZED BY A LICENSE--

(B) --DOE SHALL NOT COMMENCE CONSTRUCTION--UNLESS IT HAS FILED AN APPLICATION--AND HAS OBTAINED CONSTRUCTION AUTHORIZATION. FAILURE TO COMPLY SHALL BE GROUNDS FOR DENIAL OF A LICENSE

10 CFR 70.3 LICENSE REQUIREMENTS

--NO PERSON--SHALL--USE, --SPECIAL NUCLEAR MATERIAL EXCEPT AS AUTHORIZED IN A LICENSE--

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CONSTRUCTION AUTHORIZATION (10 CFR 60) AND CONSTRUCTION PERMIT (10 CFR 50)

WHAT IS THE DIFFERENCE?

- COMMISSION ITSELF UNCLEAR ON DIFFERENCES - USED TERMS INTERCHANGEABLY - "CA/CP/LICENSE"
- CP IS IN EFFECT A SEPARATE "LICENSE"
- CA "ENFORCEMENT" IS BASED ON NRC'S ABILITY TO DENY A LICENSE TO RECEIVE AND POSSESS IF REPOSITORY IS CONSTRUCTED WITHOUT AUTHORIZATION

10 CFR 2.4 - DEFINITIONS

(I) "LICENSE" MEANS A LICENSE OR CONSTRUCTION PERMIT ISSUED BY THE COMMISSION

(J) "LICENSEE" MEANS A PERSON AUTHORIZED TO CONDUCT ACTIVITIES UNDER A LICENSE OR CONSTRUCTION PERMIT

GENERALLY APPLICABLE LICENSING PROCEDURES 10CFR2	H.L.W. REPOSITORY 10CFR60	PRODUCTION AND UTILIZATION FACILITY 10CRF50	SPECIAL NUCLEAR MATERIAL 10CFR70
1. PRE-APPLICATION CONFERENCE 10CFR2.101(a)(1) N.W.P.A.	o SITE CHARACTERIZATION REPORT (PLAN) o SITE CHARACTERIZATION ANALYSIS	o NO REQUIREMENT o AT REQUEST OF APPLICANT: SITE SUITABILITY REPORT	o NO REQUIREMENT
2. DOCKETING THE APPLICATION 10CFR2.101(a)	o CONSTRUCTION AUTHORIZATION (CA) o LICENSE TO RECEIVE WASTE (L.W.) - COMPLETENESS REVIEW - FORMALLY DOCKETED	o CONSTRUCTION PERMIT o OPERATING LICENSE - COMPLETENESS REVIEW - REVIEW FOR TECHNICAL ADEQUACY (USUALLY DONE AFTER DOCKETING) - FORMALLY DOCKETED	o CONSTRUCTION APPROVAL - USUALLY NOT NEEDED EXCEPT PU PROCESSING AND FUEL FABRICATION o LICENSE TO RECEIVE SPECIAL NUCLEAR MATERIAL - COMPLETENESS REVIEW - FORMALLY DOCKETED

GENERALLY APPLICABLE LICENSING PROCEDURES 10CFR2	H.L.W. REPOSITORY 10CFR60	PRODUCTION AND UTILIZATION FACILITY 10CRF50	SPECIAL NUCLEAR MATERIAL 10CFR70
3. A. COMMON PRE-HEARING ACTIVITIES 10CFR2.704 2.102 (a) 2.571 2.740	o STAFF ISSUES SAFETY EVALUATION REPORT (SER) o ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) REVIEWS LICENSE APPLICATION (LA) AND SER (NOT CERTAIN PER 10CFR60) o COMMISSION ESTABLISHES ATOMIC SAFETY LICENSING BOARD PANEL (ASLBP) o ASLBP o REVIEWS L.A. o CONDUCTS PRE-HEARING CONFERENCE o CONDUCTS DISCOVERY PROCESS		
B. SPECIFIC PRE-HEARING ACTIVITIES	o ADOPTS DOE/FEIS TO THE EXTENT PRACTICABLE (NWPA) o ANNUAL REPORT TO CONGRESS (NWPA)	o ISSUE DRAFT EIS o CONSIDER PUBLIC COMMENTS o ISSUE FINAL EIS (10CFR51)	
4. PUBLIC HEARINGS 10CFR2.104(a)	o REQUIRED FOR CA AND LW	o REQUIRED FOR C.P. AND O.L. o OPTIONAL AT TIME OF DOCKETING APP. FOR C.P.	CASE SPECIFIC

CONDUCT OF HEARINGS
10CFR2 SUBPART G

- ASLBP CONVENES HEARING
- ASLB ACCEPTS EVIDENCE, ARGUMENTS AND PROPOSED FINDINGS FROM PARTIES TO THE PROCEEDINGS
- APPLICANT RESPONDS TO PROPOSED FINDINGS
- ASLB OR COMMISSION RENDERS INITIAL DECISION ON L.A. OR INITIAL DECISION IS OMITTED
- ASLAB REVIEW APPEALS IF NECESSARY
- COMMISSION ISSUES FINAL DECISION

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE

12/22/80 - COMMISSIONER BRADFORD: RIGHT. OKAY, NOW I WOULD SAY AT THAT POINT THAT THESE -- CONSTRUCTION IN ACCORDANCE WITH THESE CONDITIONS, SOMEWHAT MODIFY THE CONDITIONS WITHOUT THE PRIOR APPROVAL OF THE NRC. AND IT MAY BE THAT WE CAN'T PUT ANYBODY IN JAIL OR ANYTHING IF THEY DON'T FOLLOW THAT, BUT IT SEEMS TO ME THAT THE AUTHORITY TO PROMULGATE THESE RULES, AND THE AUTHORITY TO LICENSE THE REPOSITORY, HAS TO CARRY WITH THE ABILITY TO, WHEN WE ISSUE AN EXPLICIT LICENSE CONDITION, SAY THAT-- THEY HAVE GOT TO COME TO US FOR APPROVAL IF THEY ARE GOING TO DO SOMETHING ELSE. IF NOTHING ELSE, THE POWER THAT BACKS THAT UP IS THE IMPLICIT POWER TO TURN DOWN A LICENSE IF THEY DON'T DO IT.

MR. BICKWIT: I THINK THAT'S RIGHT, THAT YOU HAVE--

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE (CONTINUED)

1/7/81

MR. BICKWIT: THE ISSUE THAT RUNS THROUGHOUT THE RULE IS IF YOU WANT TO IMPOSE SOME CONDITIONS PRIOR TO THE ACTUAL LICENSING OF THE RECEIPT OF WASTE, I.E., PURSUANT TO CONSTRUCTION PERMIT, CONSTRUCTION AUTHORIZATION, CAN YOU ENFORCE THOSE CONDITIONS, AND IN SOME CASES THE QUESTION HAS GONE EVEN FURTHER, CAN YOU ORDER A PROSPECTIVE LICENSEE TO DO THINGS OR TO STOP DOING THINGS, EVEN BEFORE HE SUBMITS AN APPLICATION FOR A CONSTRUCTION AUTHORIZATION, WHEN HE IS NOT A LICENSEE UNDER THE ACT.

AS I SAID LAST TIME, BOTH LEGAL OFFICES OF THE COMMISSION HAVE ALWAYS SAID THAT YOU CAN'T. WE HAVE LOOKED AT IT A LITTLE HARDER AND AS FAR AS THE MEMO THAT WAS CIRCULATED, WE DIDN'T FIND IT TO BE PERSUASIVE ON THE ISSUE ONE WAY OR THE OTHER, BUT WE DID -- I GUESS OUR GENERAL STATE OF MIND AT THIS POINT IS A PRESENTABLE CASE CAN BE MADE THROUGH OTHER ARGUMENTS THAT YOU HAVE SOME ENFORCEMENT AUTHORITY, EVEN AGAINST NON-LICENSEES.

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE (CONTINUED)

I AM NOT SAYING IT IS THE MOST PERSUASIVE CASE IMAGINABLE, BUT I AM SAYING IT IS PRESENTABLE AND RESPECTABLE, AND THE ARGUMENTS IN SUPPORT OF IT ARE, ONE, THAT WE LOOKED THROUGH THE LEGISLATIVE HISTORY AND CASES AND SO ON AND SAW NOTHING THAT SAID YOU CAN'T ISSUE ORDERS AGAINST NON-LICENSEES.

WE FOUND A NUMBER OF CASES STANDING FOR THE PROPOSITION THAT AN AGENCY CAN GENERALLY DO WHAT IS NECESSARY TO PROMOTE ITS MISSION. THESE WERE FCC, FTC, FERC CASES, BUT WE FOUND CASES WHICH YOU'RE FAMILIAR WITH WOULD BE -- RELATED DIRECTLY TO THE AEC AND THE NRC, THAT THIS IS A STATUTE UNDER WHICH THERE ARE USUALLY BROAD POWERS.

AND FINALLY, THE FINAL ARGUMENT WHICH APPLIES ONLY TO THE SITUATION AFTER THE CONSTRUCTION AUTHORIZATION IS ISSUED IS THAT 161.i OF THE ACT. IT SAYS THAT THE COMMISSION CAN PRESCRIBE SUCH ORDERS AS IT MAY DEEM NECESSARY TO GOVERN ANY ACTIVITY AUTHORIZED PURSUANT TO THIS ACT. SO THAT

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE (CONTINUED)

REASONABLY EXPANSIVE READING OF THAT PROVISION WOULD ALLOW ORDERS TO ENFORCE CONDITIONS WITH RESPECT TO THE CONSTRUCTION AUTHORIZATION, BUT NOT PRIOR TO THE ISSUANCE OF THE CONSTRUCTION AUTHORIZATION.

I KNOW IT WAS ALWAYS MY VIEW AND IT'S BEEN THE VIEW OF JUST ABOUT EVERY LAWYER I'VE SPOKEN TO IN EITHER OFFICE THAT WHERE NONLICENSEES ARE CONCERNED, YOU SIMPLY CAN'T ISSUE AN ORDER TO COMPEL BEHAVIOR OR PROHIBIT BEHAVIOR.

AT THIS POINT I WOULD SAY THAT IF THE COMMISSION AS A POLICY MATTER WANTS TO ALLOW IT, WANTS TO CREATE A REGIME UNDER WHICH IT WOULD DO SO, THAT IT COULD MAKE A PRESENTABLE ARGUMENT FOR ITS AUTHORITY TO DO SO.

YOU CAN PRESCRIBE CONDITIONS UNDER A CONSTRUCTION PERMIT (SIC) WITH THE UNDERSTANDING THAT YOUR ONLY ENFORCEMENT MECHANISM IS THAT IF THOSE CONDITIONS ARE NOT MET, NO FINAL LICENSE WILL ISSUE.

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE (CONTINUED)

1/7/81 CHAIRMAN AHERNE: I THOUGHT THE GENERAL LEVERAGE THAT WE HAD PRIOR TO GRANTING THE CONSTRUCTION AUTHORIZATION -- FOR EXAMPLE, DURING THE DEVELOPMENT OF SITE CHARACTERIZATION PLANS OR DURING SITE CHARACTERIZATION ITSELF, THAT LEVERAGE EXISTED BECAUSE WE WERE SAYING THAT ESSENTIALLY, EITHER EXPLICITLY OR IMPLICITLY, IF THESE AREN'T FOLLOWED, YOU WON'T GET A CONSTRUCTION AUTHORIZATION.

1/26/81 MR. BICKWIT: IF YOU ARE TREATING THIS AS NOT A PART OF THE LICENSE UNDER THE ACT, BUT RATHER AS SIMPLY THE COMMISSION'S DEVISED MECHANISM FOR ULTIMATELY REACHING A DECISION ON THE MATERIALS LICENSE, THEN THE STATUTE DOES NOT APPLY TO THIS IN THE WAY THAT IT APPLIES TO CONSTRUCTION PERMIT AMENDMENTS.

QUOTES FROM COMMISSION DISCUSSIONS ON NRC AUTHORITY PRIOR TO LICENSE ISSUANCE (CONTINUED)

BECAUSE THIS ISN'T A LICENSE, THE STATUTORY REQUIREMENT FOR THE GRANTING OF A MATERIALS LICENSE IS FOR THE GRANTING OF A LICENSE TO RECEIVE WASTES.

COMMISSIONER GILINSKY: YOU ARE DISTINGUISHING BETWEEN THE CONSTRUCTION OF THE FACILITY AND RECEIVING THE WASTES?

MR. BICKWIT: I AM DISTINGUISHING BETWEEN THOSE TWO. IT IS CLEAR THAT YOU MUST HAVE A LICENSE FOR THE LATTER.

10 CFR 60

NRC ENFORCEMENT OPTIONS

1. PRE-CA

   - NO DIRECT ENFORCEMENT CAPABILITY

     - CIVIL ACTION?
     - LEGISLATION?

   - DOE CONSIDERED TO BE PROSPECTIVE "APPLICANT" IN CONTEXT OF 10 CFR 2.101

     - "INFORMAL CONFERENCE"

   - FAILURE TO COMPLY WILL RESULT IN NRC REFUSAL TO DOCKET AND/OR GRANT CA

2. CA - DOE IS APPLICANT

   - NRC AUTHORITY TO ENFORCE CA REQUIREMENTS AND RESTRICTIONS IS SUBJECT TO DEBATE

10 CFR 60

NRC ENFORCEMENT OPTIONS (CONTINUED)

- STANDARDS FOR ISSUANCE OF A LICENSE (60.41(A)) STATES:

  - CONSTRUCTION -- HAS BEEN SUBSTANTIALLY COMPLETED IN CONFORMANCE WITH THE APPLICATION--AND THE RULES AND REGULATIONS OF THE COMMISSION

3. AFTER LICENSE ISSUED (10 CFR 2, SUBPART B AND APPENDIX C)*

   - SANCTIONS INCLUDE (BASED ON SEVERITY)

     - IMPOSE REQUIREMENTS BY ORDER
     - MODIFY LICENSE
     - SUSPEND LICENSE

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* APPLICABLE TO CP UNDER PART 50 10 CFR 50.55(C)--THE CONSTRUCTION PERMIT SHALL BE SUBJECT TO THE SAME CONDITIONS TO WHICH A LICENSE IS SUBJECT

10 CFR 60

NRC ENFORCEMENT OPTIONS (CONTINUED)

- REVOKE LICENSE
- IMPOSE CIVIL PENALTIES
- REFERRAL TO JUSTICE DEPARTMENT FOR INVESTIGATION

o PROCEDURAL REQUIREMENTS

- NOTICE OF VIOLATION
- SHOW CAUSE ORDERS
- HEARINGS

LEGISLATIVE BASE

o CHAPTER 18 OF AEA PROVIDES FOR CRIMINAL PENALTIES FOR WILLFUL VIOLATIONS OF THE ACT, REGULATIONS, OR ORDERS

- REFERRED TO JUSTICE DEPARTMENT FOR "APPROPRIATE ACTION"

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PAST NUCLEAR FACILITY LICENSING EXPERIENCE

DAVE TILLSON

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NRC PERSPECTIVE

PAUL PRESTHOLT

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KEY REGULATORY EVENTS

& ASSOCIATED CONSIDERATIONS

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GENERAL CONSIDERATIONS

- KEY REGULATORY EVENTS ARE DEFINED IN NWPA, 10 CFR 2 AND 10 CFR 60 BUT ARE SUBJECT TO EXTERNAL COMPLICATING FACTORS RESULTING FROM:

  1. LACK OF DIRECT PRECEDENT
  2. MODIFIED PROCEDURAL PROCESS AND IMPLEMENTATION, UNCERTAINTY AND AUTHORITY
  3. PAST REACTOR LICENSING EXPERIENCE
  4. GOVERNMENT AGENCY LICENSEE
  5. GENERAL NATURE OF APPLICABLE RULES WITH CONSEQUENT INTERPRETATIVE FLEXIBILITY

- ALTHOUGH A SERIES OF DISCRETE "EVENTS" ARE DEFINED IN THE REGULATIONS - THEY SHOULD BE TREATED AS A CONTINUUM - EACH PROVIDING PART OF THE FOUNDATION FOR REACHING A SUCCESSFUL CONCLUSION

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KEY NRC RELATED REGULATORY/LICENSING EVENTS

1. SITE CHARACTERIZATION PLAN

   - o MINIMIZE POTENTIAL FOR NRC/STATE/PUBLIC CRITICISM

     - BALANCED/OBJECTIVE
     - COMPREHENSIVE (RG4.17)
     - CONSIDERATION OF PREVIOUSLY KNOWN CONCERNS/ISSUES (NRC MEETINGS, APPLICABLE EA COMMENTS, HEARINGS, ETC.).

2. SITE CHARACTERIZATION ANALYSIS

   - o FIRST "OFFICIAL NRC POSITION" ON SCP
   - o NRC PERCEPTION OF "ADEQUACY" WILL, TO LARGE EXTENT, BE BASED ON HOW WE HAVE ADDRESSED KNOWN CONCERNS AT TIME OF SCP SUBMITTAL

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

- PROVIDE BASIS FOR SEMIANNUAL UPDATES AND REFINEMENT OF SC PROGRAM
  - DISCUSSION & RESOLUTION
  - DOCUMENTATION TRAIL
- NRC COMMENTS WILL REFLECT WHAT THEY EXPECT TO SEE IN LA

3. LICENSE APPLICATION (SAR/EIS EMPHASIS)

- PROCEDURAL AND CONTENT REQUIRMENTS SPECIFIED IN 10 CFR 2 AND 10 CFR 60
- DEMONSTRATE COMPLIANCE WITH ALL "ITEMS" IN, OR REFERENCED IN, 10 CFR 60
- PROVIDE SUPPORT FOR REASONABLE ASSURANCE FINDING

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

- EIS/SAR CONSISTENCY IS ESSENTIAL
  - INCORPORATE RESULTS OF "INFORMAL" PRE-APPLICATION AGREEMENTS - LIMIT POTENTIAL ISSUES
  - PUBLICALLY AVAILABLE

4. LICENSE APPLICATION DOCKETING

- NRC REVIEW FOR COMPLETENESS AND ACCEPTABILITY
  - INCLUDES ER/EIS

- DIRECTOR MAY DETERMINE THAT APPLICATION IS NOT ACCEPTABLE IF IT
  - DOES NOT INCLUDE REQUIRED SITE CHARACTERIATION DATA INCLUDING IN-SITU DATA

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

- APPLICATION SUBJECT TO DENIAL. DOE DOES NOT PROVIDE ADDITIONAL NECESSARY INFORMATION WITHIN SPECIFIED TIME
  - APPLICATION DOCKETING NOTICE WILL INCLUDE THAT HEARING IS REQUIRED PRIOR TO CA

5. STAFF TECHNICAL REVIEW
   - STAFF ESTABLISHES SCHEDULE
   - ACRS REFERRAL (?)
   - TECHNICAL REVIEW WILL BE EXPEDITED IF OPPORTUNITY FOR PRE-APPLICATION CONSULTATION WAS EFFECTIVE AND DOCUMENTED
   - FORMAL HEARING PROCESS-EXPARTE RULE

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

- CONTINUING Q & A
- BURDEN OF PROOF ON DOE - CONVINCE NRC STAFF
- "SER" OR EQUIVALENT DOCUMENT

6. ASLB HEARING (ADJUDICATORY)
   - REQUIRED BY 10 CFR 2
   - NRC ESTABLISHES BOARD AND CONDUCTS PROCEEDINGS UNDER 10 CFR 2
   - LEGAL & TECHNICAL MEMBERS
   - PRESIDING OFFICER HAS AUTHORITY TO SCHEDULE & ORGANIZE HEARINGS

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KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

- CONTENT CAN BE BOTH NEPA AND "TECHNICAL"
- SUPPORTIVE NRC STAFF POSITION ESSENTIAL
- BOTH DOE & NRC POSITIONS SUBJECT TO REBUTTAL
  - INTERVENTION
  - CROSS EXAMINATION
  - DISCOVERY
- KNOWN ISSUES MUST BE RESOLVED, OR DEFENSE PREPARED, PRIOR TO HEARING FOR SUCCESSFUL OUTCOME
- ASLAB
- ASLB ISSUES FINDING TO COMMISSION

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

7. CONSTRUCTION AUTHORIZATION ISSUED BY COMMISSION

- BASED ON ASLB/STAFF AND ACRS
- "CONDITIONS" SPECIFIED IN CA - AMENDMENT REQUIRED PRIOR TO "MAJOR" MODIFICATION DURING CONSTRUCTION
- FAILURE TO COMPLY WITH CA CAUSE FOR DENIAL OF LICENSE
  - REASONABLE ASSURANCE THAT PERFORMANCE OBJECTIVES WILL BE MET
  - ENVIRONMENTAL
  - ADEQUATE DESCRIPTION OF SITE
  - QA/TRAINING/EMERGENCY PLAN/OPERATING PROCEDURES

KEY NRC RELATED REGULATORY/ LICENSING EVENTS (CONTINUED)

8. LICENSE APPLICATION UPDATE

- INFORMATION NOT AVAILABLE AT TIME OF CA ISSUANCE
- REQUIRED NRC FINDINGS
  - CONSTRUCTION ESSENTIALLY COMPLETE IN CONFORMANCE WITH THE APPLICATION (CA CONFORMANCE IMPLICIT)
  - ACTIVITIES IN CONFORMITY WITH LEGISLATION AND COMMISSION RULES
  - COMMON DEFENSE AND SECURITY - PUBLIC HEALTH AND SAFETY ARE PROTECTED
  - ALL APPLICABLE NEPA (PART 51) REQUIREMENTS SATISFIED

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NNWSI PROJECT

REGULATORY NEEDS AND STRATEGY

T-RG-Glora-05/29/85

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REGULATORY STRATEGY

GOVERNING PRINCIPLES

1. ALL PAST AND FUTURE ACTIVITIES HAVE POTENTIAL TO AFFECT LICENSING

2. ALL KNOWN ISSUES AND CONCERNS MUST BE ADDRESSED, AND AGREEMENT REACHED WITH NRC STAFF BEFORE LICENSE APPLICATION

3. MAINTAIN GOOD WORKING RELATIONSHIP, AND MUTUAL TECHNICAL RESPECT BETWEEN DOE AND NRC

   - o FREE AND OPEN DISCUSSION
   - o WILLINGNESS TO COMPROMISE/NEGOTIATE
   - o AVOID RIGIDITY, DO NOT AVOID CONFRONTING A PROBLEM
   - o ADDRESS/CONSIDER ALL COMMENTS AND RECOMMENDATIONS

4. SUCCESSFUL LICENSE APPLICATION IS SHARED RESPONSIBILITY AMONG ALL PARTICIPANTS AND CONTRACTORS

   - o CONSISTENT AND SYSTEMATIC CONSIDERATION OF REPOSITORY SYSTEM
   - o UNDERSTAND PROCESS AND COMMIT TO SUPPORTING IT

REGULATORY STRATEGY (CONTINUED)

5. A RETRIEVABLE DOCUMENTATION/DECISION TRAIL WILL BE ESSENTIAL TO OBTAINING CA AND LICENSE

6. QUALITY ASSURANCE

7. NRC IS FORMULATING THEIR INTERPRETATIONS AND POSITIONS IN PARALLEL WITH DOE

   - o INFLUENCE
   - o ASSIST
   - o COOPERATE

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MAJOR NEED CATEGORIES

- IMPROVE UNDERSTANDING OF LICENSING PROCESS, REGULATIONS, AND CONSEQUENT COMMITMENTS AND RESPONSIBILITIES
  - INDIVIDUAL STAFF MEMBERS
  - PARTICIPANTS
  - WMPO
  - PROGRAM
- IMPORVE COMMUNICATION
  - NRC <-> NNWSI PROJECT
  - WITHIN PARTICIPANT ORGANIZATIONS
  - WITHIN PROJECT
  - PROJECT <-> HQ
- IMPROVE DOCUMENTATION CONTROL ("CORPORATE HISTORY")
- DEVELOP PROJECT-WIDE CRITICAL REVIEW, ASSESSMENT, AND INTEGRATION MENTALITY

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REGULATORY STRATEGY

NEED	APPROACH/CONSIDERATIONS
1. UNDERSTAND/CLARIFY REQUIREMENTS AND EXPECTATIONS	o DEFINE OBJECTIVES o ACTIVE 2-WAY INTERACTIONS o POSITION PAPERS AND POSITIONS - NEGOTIATION AND FLEXIBILITY o CONSISTENT STRATEGY - RCP o LICENSING PROCESS FAMILIARIZATION
2. COMMUNICATION	o PROCEDURES AND RCP o REGULATORY CONTACTS (INTERNAL AND EXTERNAL)
3. DOCUMENTATION AND TRACEABILITY	o FUNCTIONAL LIMS/LIS o DOE/NRC MEETING RESULTS o DECISIONS/POSITIONS o FULL RETRIEVABILITY OF RECORD

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REGULATORY STRATEGY (CONTINUED)

4. INTERNAL INTEGRATION -- TECHNICAL AND "REGULATORY" ASSESSMENT

- EMPHASIS ON CONTINUAL COMPARATIVE EVALUATION OF STATUS AGAINST REGULATIONS
- ACTIVE IDENTIFICATION OF ISSUES - RESOLVE BEFORE LA
- CONFRONTATION - NOT AVOIDANCE
- RELATE TO SYSTEM IMPACTS

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REGULATORY COMPLIANCE PLAN

- STATEMENT OF PROBLEM AND BOUNDS
  - REGULATORY PROCESS
  - AUTHORITIES AND RESPONSIBILITIES (NRC & DOE)
  - PRE AND POST LA
- NNWSI PROJECT/NRC INTERACTIONS
  - PURPOSE
  - LIMITATIONS
  - IMPLEMENTATION OF AGREEMENT(S)
- LICENSING DEMONSTRATION BASIS
  - ISSUE IDENTIFICATION
  - METHODS OF RESOLUTION
  - RESOLUTION PROCESS
    - INTERNAL
    - EXTERNAL
    - PEER REVIEW
    - NRC CONCURRENCE

REGULATORY COMPLIANCE PLAN (continued)

- LICENSING DEMONSTRATING METHODS
  - COMMITMENTS
  - POSITIONS
  - TRACKING
  - DOCUMENTATION

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NRC/NNWSI PROJECT MEETING STRATEGY

- EQUITABLE PARTICIPATION AND CONTRIBUTION
  - DOCUMENTS
  - CONCURRENCE
  - TECHNICAL NEGOTIATION
- CLEAR STATEMENT OF OBJECTIVES AND OUTCOME
  - WHAT DO WE NEED
  - WHAT DO THEY NEED
- DOCUMENTATION
  - PLANNING/SCHEDULING
  - SUMMARY
- PROCEDURES

Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, NV 89114-4100

JUN 06 1985

W. J. Purcell, Director, Office of Geologic Repositories, DOE/HQ (RW-20), FORSTL

NNWSI PROJECT WEEKLY HIGHLIGHTS FOR WEEK ENDING JUNE 6, 1985

I. Issues Requiring Involvement of HQ or Other Projects

A. New Issues:

None to report.

B. Previously Reported Issues:

	Issue	Status	First Report Date
1.	Regarding March 18 letter to Purcell requesting support to resolve OCRWM position on transportation, a meeting or plan is required to clarify issues and document OCRWM policy positions.	Open	3/20/85
2.	Regarding March 19 letter to E. S. Burton - EA Briefings and Hearings - requested copy of documents generated as a result of "Roles and Responsibilities at Briefings" memo.	Open - Per ISGG Meeting 5/9-10, should be available 6/15.	5/14/85
3.	Regarding May 17 request for HQ to contact NRC for responses to NNWSI Project questions posed at the December DOE/NRC QA meeting.	Open	6/6/85

II. Major Internal Concerns

None to report.

III. Significant Accomplishments (SA)/Information Items (II)

SA

The NNWSI Project draft EA Comment/Response Appendix was sent to HQ for review on schedule. The drafts were due at HQ on June 3.

SNL has completed a review of the Bechtel Quality Assurance Plan (QAP) for the repository surface facilities conceptual design. Comments were sent to Bechtel for incorporation into the QAP.

II

Approximately 20 people representing an SP-100 Site Evaluation Committee and Technical Advisory Committee toured the NTS and E-MAD on May 28. The group appeared to be impressed with the E-MAD facility and the condition in which it is maintained. A briefing was then given to the group at DOE/NV in Las Vegas on May 29. Five sites are being evaluated by the committee. Results from the tour will be included in the committee's report to DOE/HQ which is due in July.

The DOE Inspector General review team visited WMPO on June 3-4. They were briefed on the NNWSI Project and obtained all of the information requested. A memo is being sent to HQ to document information provided to the IG and areas discussed during the meeting.

Senate Bill 56 has passed the Nevada legislature and is on the Governor's desk awaiting signature. The Governor has ten days to sign the bill. Because the Nevada Waste Project Office (NWPO) budget is tied into this legislation, failure to sign will leave the NWPO without funding as of July 1. The bill establishes a seven-member commission on nuclear projects that would direct NWPO activities, removing direct jurisdiction from the Governor.

IV. Upcoming Events

1. Coordination Group Meetings

- Tuesday-Thursday, June 25-27: Waste Package Coordination Group Meeting, Denver.

2. HQ Meetings

- Friday, June 7: Program Managers' Meeting, Washington, D.C.

3. Internal Project and DOE/NV Meetings

- o Monday, June 17: SCP Management Group Meeting, Las Vegas.
- o Tuesday, June 18: ESTP Committee Meeting, Las Vegas.
- o Tuesday, June 18: QA Software SOP Meeting, Las Vegas.
- o Wednesday, June 19: Talk to LV Chamber of Commerce Prospector's Club - Mitch Kunich.
- o Wednesday-Thursday, June 26-27: PM-TPO Meeting, Las Vegas.
- o Tuesday, July 9: SOC Meeting, NTS.
- o Tuesday-Thursday, July 9-11: Waste Package QA Audit, Livermore.
- o Thursday-Friday, July 11-12: ESTP Committee Meeting, Las Vegas (tentative).

4. State and Public Interaction

- o Thursday-Wednesday, June 13-19: USNCTT, New York (Don Vieth).
- o Friday, June 21: State EA Comment - Clarification Meeting.
- o Wednesday, July 10: Pine County Commissioners/Ely Town Meeting.

5. NRC Interaction

- o Tuesday-Wednesday, July 23-24: NRC/DOE Waste Package Meeting.

Donald L. Vieth, Director
Waste Management Project Office

WMPO:DLV-1095

REVISED QA AUDIT SCHEDULE FY 85

AUDIT NO.	DATE	ORGANIZATION	ACTIVITIES	REQUIREMENTS
85-1	APRIL	WMPO/NV	AUDIT AND SURVEILLANCE	NVO-196-18
85-2	MAY	WMPO/NV	ORGANIZATION, INDOCTRINATION AND TRAINING	NVO-196-18
85-3	MAY	WMPO/NV	NCR, CAR, TREND ANALYSES AND SUPPLIER EVALUATIONS	NVO-196-18
85-4	MAY	WMPO/NV	DOCUMENT CONTROL AND RECORDS	NVO-196-18
85-5	MAY	WMPO/NV	DOCUMENT, REVIEW, APPROVALS AND PEER REVIEWS	NVO-196-18
85-6	JULY	LLNL	NNWSI ACTIVITIES 9-10-11	NVO-196-17 AND LLNL IMPLEMENTING QA PROCEDURES
85-7	JULY	WESTINGHOUSE	NNWSI ACTIVITIES	NVO-196-17 AND W IMPLEMENTING QA PROCEDURES
85-8	AUGUST	SNL	NNWSI ACTIVITIES	NVO-196-17 AND SNL IMPLEMENTING QA PROCEDURES
85-9	AUGUST	H&N	NNWSI ACTIVITIES	NVO-196-17 AND H&N IMPLEMENTING QA PROCEDURES
85-10	AUGUST	F&S	NNWSI ACTIVITIES	NVO-196-17 AND F&S IMPLEMENTING QA PROCEDURES
85-11	SEPTEMBER	LANL	NNWSI ACTIVITIES	NVO-196-17 AND LANL IMPLEMENTING QA PROCEDURES
85-12	SEPTEMBER	USGS DENVER	NNWSI ACTIVITIES	NVO-196-17 AND USGS IMPLEMENTING QA PROCEDURES
85-13	SEPTEMBER	REECo	NNWSI ACTIVITIES	NVO-196-17 AND REECo IMPLEMENTING PROCEDURES
85-14	SEPTEMBER	USGS MENLO PARK	NNWSI ACTIVITIES	NVO-196-17 AND USGS IMPLEMENTING QA PROCEDURES
85-15	SEPTEMBER	SAIC/T&MSS	NNWSI ACTIVITIES	NVO-196-17 AND SAIC/T&MSS IMPLEMENTING QA PROCEDURES

DISCOVERY AND ALLEGATIONS

TWO IMPORTANT CONSIDERATIONS

IN ANY LICENSED NUCLEAR PROJECT

George Freond
SAIC

- ARE YOU WILLING TO SEE ANY DOCUMENT DEALING WITH ANY ASPECT OF THIS PROJECT PRINTED IN TOMORROW'S NEWSPAPER?

THAT'S DISCOVERY!

- WOULD YOU LIKE TO HAVE THE NRC INVESTIGATE EACH AND EVERY CONCERN AND COMPLAINT BY ANYONE ASSOCIATED WITH THIS PROJECT?

THAT'S ALLEGATIONS!

DISCOVERY (PRODUCTION OF DOCUMENTS)

- IS A PART OF THE TOTAL PROCESS IN PREPARING FOR A TRIAL OR CONTESTED HEARING, AND INCLUDES INTERROGATORIES AND DEPOSITIONS

- FOR THIS TALK, FOCUS IS ON PRODUCTION OF DOCUMENTS

- FOR NRC HEARINGS, DERIVES ITS AUTHORITY FROM 10 CFR 2.741, WHICH SPECIFIES SCOPE, CONTENTS, SERVICE, AND RESPONSE

DISCOVERY

- IS A POWERFUL TOOL IN THE HANDS OF A WELL ORGANIZED INTERVENOR GROUP
- HAS A LARGE POTENTIAL IMPACT ON INFORMATION MANAGEMENT
- SHOULD BE CONSIDERED FROM THE START OF A PROJECT

THE PURPOSE OF DISCOVERY

- AT BEST

  TO UNCOVER EVIDENCE OF LEGITIMATE TECHNICAL DISAGREEMENT IGNORED IN A FINAL PROJECT DOCUMENT

- AT WORST

  TO DESTROY THE CREDIBILITY OF THE CONSENSUS (PEER REVIEW) PROCESS BY BLOWING THE NORMAL DISAGREEMENTS TOTALLY OUT OF PROPORTION

DOCUMENTS CAN BE DEFINED AS

- PRINTED MATERIAL
- WRITTEN MATTER AND HANDWRITTEN NOTES
- PHOTOGRAPHS AND XEROX REPRODUCTIONS
- AUDIO AND VIDEO RECORDINGS

WRITINGS AND RECORDINGS CONSIST OF

- LETTERS, WORDS, AND NUMBERS OR THEIR EQUIVALENTS
- SET DOWN BY HANDWRITING, TYPEWRITING, PRINTING, PHOTOSTATING, PHOTOGRAPHING, MAGNETIC IMPULSE, MECHANICAL OR ELECTRONIC RECORDING, OR OTHER FORM OF DATA COMPILATION

DOCUMENTS REQUESTED CAN INCLUDE

- EACH AND EVERY DRAFT OF EACH AND EVERY TECHNICAL REPORT IN A CERTAIN GENERIC CATEGORY, INCLUDING REVISIONS, AND EACH AND EVERY DRAFT OF ANY SECTION OF ANY SUCH REPORT OR REVISION

- EACH AND EVERY DOCUMENT DISCUSSING OR COMMENTING ON ANY SUCH REPORT OR DRAFT OF ANY SUCH REPORT OR ANY PORTION THEREOF

FILE SOURCES OF DOCUMENTS INCLUDE

- MASTER PROJECT FILES
- THE PARENT COMPANY AND AFFILIATES
- DEPARTMENTS, DIVISIONS, UNITS, SUB-UNITS, AND INDIVIDUAL EMPLOYEES
- AGENTS, CONTRACTORS, SUBCONTRACTORS, AND ATTORNEYS

DO YOU WANT TO DEAL WITH DISCOVERY

- BY AFTER-HOUR TELEPHONE CALLS
- BY A GENERAL HOUSECLEANING OF FILES PRIOR TO THE START OF THE HEARING PROCESS
- BY ADVANCE PLANNING AND A STRUCTURED PROCESS FOR INFORMATION MANAGEMENT

THIS PROCESS SHOULD COVER BOTH

- ORIGINAL DOCUMENTS
- LETTERS OR REPORTS COMMENTING ON OTHER DOCUMENTS

THE ELEMENTS OF THE PROCESS SHOULD INCLUDE

- FORMAL ASSIGNMENT OF RESPONSIBILITIES
- GUIDANCE FOR DOCUMENT PREPARATION, APPROVAL, AND RETENTION

THE ASSIGNMENT OF RESPONSIBILITIES SHOULD IDENTIFY

- PRIMARY AUTHOR(s) - THE INDIVIDUAL(s) OR GROUP RESPONSIBLE FOR PREPARING THE DOCUMENT, OR ANY SECTION FOR A COMPLEX DOCUMENT
- THOSE INDIVIDUALS PROVIDING SECONDARY INPUT
- THE MANAGER(s) REQUIRED TO APPROVE THE DOCUMENT
- THE SIGNATURE(s) TO APPEAR ON THE FINAL DOCUMENT

DOCUMENT PREPARATION AND APPROVAL

- DISTINGUISH BETWEEN FORMAL AND INFORMAL - BOTH DRAFTS AND COMMENTS

- STRIKE A BALANCE BETWEEN THE CRITICAL AND THE TRIVIAL

- PUT SOME BURDEN ON THE RESPONSIBLE DISSENTER

FORMAL DRAFTS

FIRST - SATISFIES PRIMARY AUTHOR(s)

SECOND - ADDRESSES INITIAL COMMENTS OF OTHERS

THIRD - INPUT TO MANAGEMENT APPROVAL PROCESS

FORMAL COMMENTS

- INITIAL COMMENTS ARE ALWAYS INFORMAL
- FORMAL COMMENTS
  - BEFORE MANAGEMENT APPROVAL
  - AFTER ISSUANCE
- FORMAL COMMENTS REQUIRE A FORMAL RESPONSE FOR THE RECORD

DOCUMENT RETENTION

- RETAIN ONLY FORMAL DRAFTS IN FILES UNDER COMPANY CONTROL

- DISPOSE OF INFORMAL DRAFTS IN WORD PROCESSORS ONCE FORMAL DRAFT HAS BEEN PREPARED

- MAKE INDIVIDUALS RESPONSIBLE FOR CONSIDERING DISCOVERY WHEN MAINTAINING THEIR PERSONAL FILES

ALLEGATIONS

BASIS

- ALLEGATIONS OF POOR WORKMANSHIP, INTIMIDATION, ETC., MUST BE INVESTIGATED BY BOTH THE LICENSEE AND THE NRC

- THE LICENSING BOARD AND THE COMMISSION MUST DETERMINE THAT PAST ALLEGATIONS HAVE BEEN ADEQUATELY INVESTIGATED AND THAT A SATISFACTORY PROCESS EXISTS FOR DEALING WITH FUTURE ALLEGATIONS

ALLEGATIONS

SCOPE OF PROBLEM

- THE USE OF ALLEGATIONS IS A RECOGNIZED TECHNIQUE BY INTERVENOR GROUPS TO ATTEMPT DELAYING THE COMPLETION OF NUCLEAR PROJECTS

- THE GOVERNMENT ACCOUNTABILITY PROJECT SUBMITTED OVER 1400 ALLEGATIONS ON DIABLO CANYON

- THESE ALLEGATIONS WERE NOT SCREENED IN ANY WAY FOR DUPLICATION, SIGNIFICANCE, ETC., PRIOR TO SUBMITTAL

HOW TO ANTICIPATE ALLEGATIONS

- ENCOURAGE OPEN COMMUNICATION AT ALL LEVELS AND IN ALL ORGANIZATIONS ASSOCIATED WITH THE PROJECT

- PROVIDE MECHANISM(s) FOR EMPLOYEES TO COMMUNICATE THEIR CONCERNS WITHOUT FEAR (REAL OR IMAGINED) OF REPRISAL

- A QA HOTLINE IS ONE SUCH MECHANISM THAT HAS PROVEN EFFECTIVE

SUMMARY

- ALLEGATIONS AND DISCOVERY, SPECIFICALLY PRODUCTION OF DOCUMENTS, ARE TWO OF THE POTENTIALLY MOST TROUBLESOME ASPECTS OF THE NRC LICENSING PROCESS

- THEY MAY INVOLVE ALL INDIVIDUAL PARTICIPANTS IN A PROJECT, SO AT THE TIME, MANAGEMENT HAS LITTLE CONTROL OVER THEIR OUTCOME

- ADVANCE PLANNING AND AN ENVIRONMENT OF OPEN COMMUNICATION -- BOTH WRITTEN AND VERBAL -- CAN DO MUCH TO REDUCE THE EFFECTIVENESS OF INTERVENOR GROUPS IN USING ALLEGATIONS AND THE DISCOVERY PROCESS AS DELAYING TACTICS

SCP
GENERAL COMMENTS

5/30/85

- COMMENTS TO DOE/HQ MP AND STYLE GUIDE BEING PREPARED
- WORK INSTRUCTIONS: SECTIONS OF CHAPTERS 1, 3, AND 8.6 OUTSTANDING
- WANG SYSTEM AT SAIC; TEST CASES RETURNED BY SNL, LANL, AND LLNL
- SCHEDULE SLIPPING DUE TO EA
- POTENTIAL SCHEDULE MODIFICATIONS DUE TO DOE/HQ MP
- ISSUES HIERARCHY:
  - KI 1, 2, 4: MINOR WORD CHANGES
  - KI 3: M. FOLEY REVISING
    J. YOUNKER TO SUMMARIZE,
    TO BE AVAILABLE MID AUGUST

WORKING GROUP MEETINGS

- CHAPTER 1-7: NONE PLANNED

Information Needs

- SECTION 8.3: WAITING ON DRAFT I.N. OUTLINES
- CHAPTER 8 (REST): NONE PLANNED
- PRODUCTION, REVIEW, AND CONTROL: JUNE 4 TO FINALIZE W.I.s

TECHNICAL DATA AND DESIGN CHAPTERS
WORKING SCHEDULE

CHAPTER	BASELINED DATE	EXPECTED DATE
0	5/24	7/26
1	5/8	6/7
2	5/8	5/30 (2nd d.)
3	5/22	6/7
4	5/29	7/10
5	(4/19)	6/7
6	6/26	7/19
7	4/17	5/29

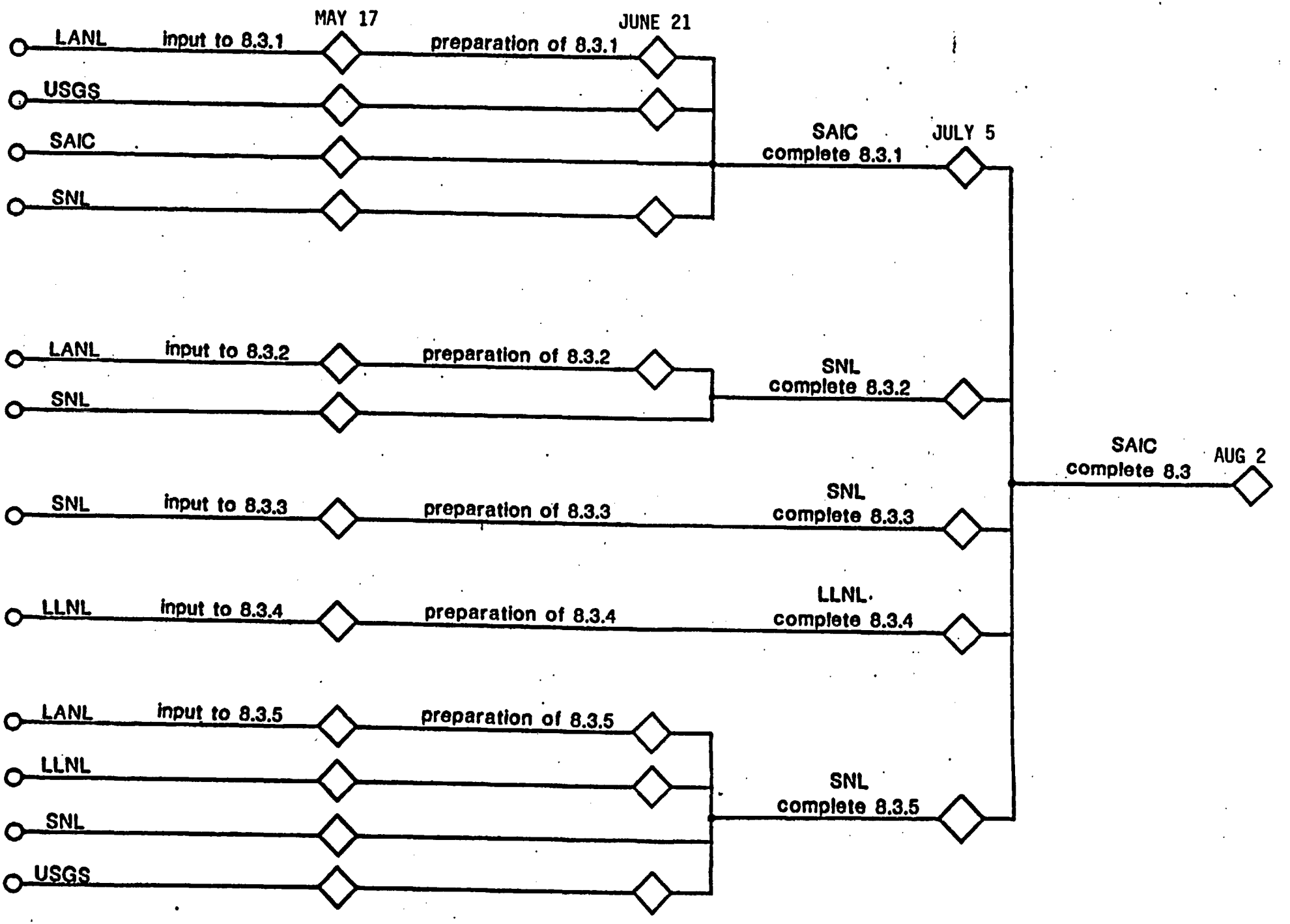
TECHNICAL DATA AND DESIGN CHAPTERS
CONCERNS FROM INITIAL REVIEWS

- COMPLIANCE WITH THE ANNOTATED OUTLINE
- COMPLIANCE WITH THE STYLE GUIDE
- CROSS-REFERENCING: WITHIN CHAPTER
  BETWEEN TD&D CHAPTERS
  WITH CHAPTER 8 (8.3)
- MORE EXTENSIVE REFERENCING
- REFERENCES, GLOSSARY, ABBREVIATIONS
- COPYRIGHT CLEARANCES

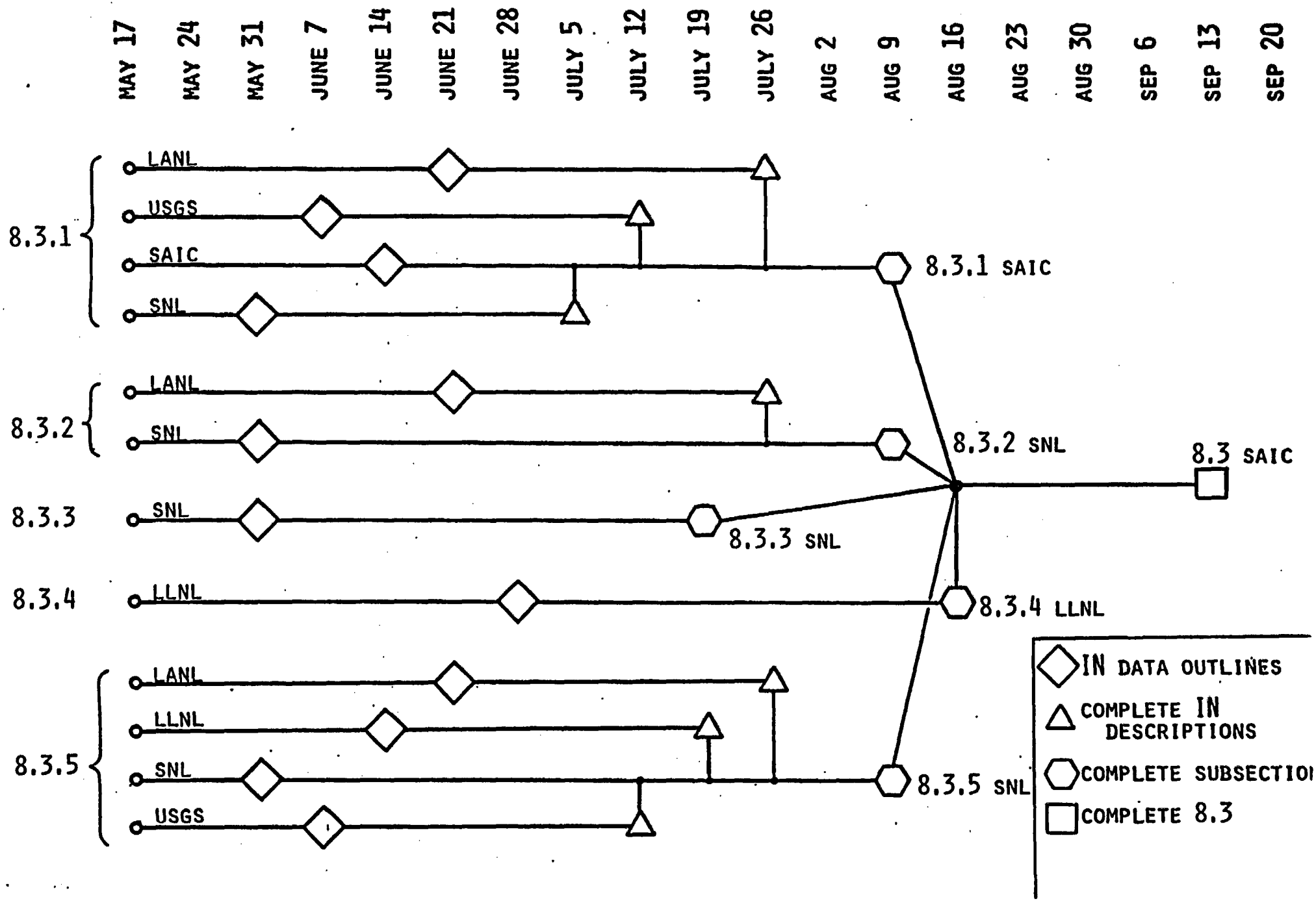
ISSUES AND PLANS CHAPTER
WORKING SCHEDULE

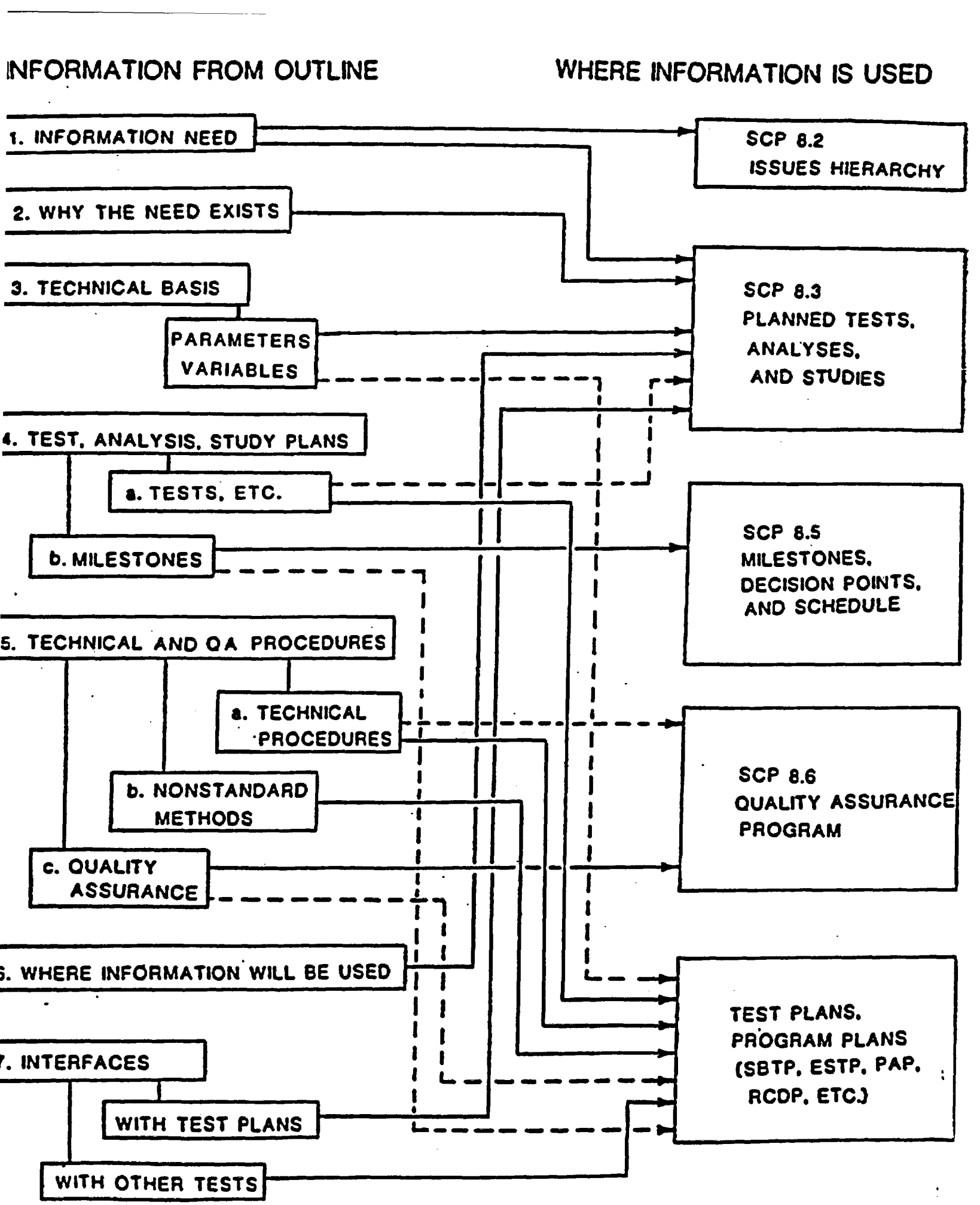
SECTION	BASELINED DATE	EXPECTED DATE
8.0		9/6
8.1	5/3	6/14
8.2	5/17	6/14
8.3	8/2	9/13
8.4	5/31	6/7
8.5	7/5	8/16
8.6	6/18	7/2
8.7	5/17	5/31

8.3 SCHEDULE


MAY 17
JUNE 21
LANL
input to 8.3.1
preparation of 8.3.1
USGS
SAIC
SNL
SAIC
complete 8.3.1
JULY 5
LANL
input to 8.3.2
preparation of 8.3.2
SNL
SNL
complete 8.3.2
SAIC
complete 8.3
AUG 2
SNL
input to 8.3.3
preparation of 8.3.3
SNL
complete 8.3.3
LLNL
input to 8.3.4
preparation of 8.3.4
LLNL
complete 8.3.4
LANL
input to 8.3.5
preparation of 8.3.5
LLNL
SNL
USGS
SNL
complete 8.3.5

WORKING SCHEDULE FOR SECTION 8.3




INFORMATION FROM OUTLINE
WHERE INFORMATION IS USED
1. INFORMATION NEED
2. WHY THE NEED EXISTS
3. TECHNICAL BASIS
PARAMETERS
VARIABLES
4. TEST, ANALYSIS, STUDY PLANS
a. TESTS, ETC.
b. MILESTONES
5. TECHNICAL AND QA PROCEDURES
a. TECHNICAL PROCEDURES
b. NONSTANDARD METHODS
c. QUALITY ASSURANCE
6. WHERE INFORMATION WILL BE USED
7. INTERFACES
WITH TEST PLANS
WITH OTHER TESTS
SCP 8.2
ISSUES HIERARCHY
SCP 8.3
PLANNED TESTS, ANALYSES, AND STUDIES
SCP 8.5
MILESTONES, DECISION POINTS, AND SCHEDULE
SCP 8.6
QUALITY ASSURANCE PROGRAM
TEST PLANS, PROGRAM PLANS (SBTP, ESTP, PAP, RCDP, ETC.)

INTERNAL REVIEW COMMITTEES (IRCs)

Technical Advisory Group

- TAG MEMBERSHIP CONFIRMED BY LLNL, LANL, USGS, SNL
- DOE/HQ'S ROLE IN FIRST REVIEW CYCLE TO BE RESOLVED
- GOALS OF INTERNAL REVIEWS TO BE STATED IN A COVER LETTER
- ROLE OF PRIMARY AUTHORS TO BE RESOLVED

Internal Review Committee

IRC FOR CHAPTER 2

TAG MEMBERS	WES PATRICK, LLNL STEVE FRANCIS, LANL BOB RAUP (RICK SPENGLER/BILL ELLIS), USGS
DOE - HQ	J. RHODERICK CAROL HANLON JEFF NELSON, WESTON
QA	_____
MANAGEMENT	MIKE VOEGELE, SAIC MAX BLANCHARD, WMPO UEL CLANTON, WMPO VERN WITHERILL, WMPO } 2 OF THESE
REGULATORY	_____

SCHEDULE

- WORKING SCHEDULE FOR INFORMATION ONLY
  - NOT TO BE BASELINED AT THIS STAGE
- PRESENT SLIPS BASED ON EA - POTENTIAL FURTHER SLIPS
- DOE/HQ CYCLE 4 REVIEW
- CYCLE 3 REVIEWS (DOE/HQ AND NNWSI PROJECT INTERNAL CONSISTENCY REVIEW) IN SERIES
- BAR CHARTS
- EA/SCP CONFLICTS IN PRODUCTION

PROTOTYPE AIR CORING

WHY IT'S NEEDED:

- ~7500 FT OF 30 TO 300* FT AIR CORED LATERAL HOLES IN ESF
- ~2000 FT OF ~100 TO 520 FT AIR CORED VERTICAL HOLES IN ESF

*300 FT LENGTH BASED ON USGS "MINIMUM ACCEPTABLE" CRITERIA FOR DRILLING THE SIX 2000+ FT LONG LATERAL HOLES

PROTOTYPE AIR CORING

STATE OF THE ART:

ONE AIR CORED LATERAL HOLE IN SALT TO 700 FT LENGTH
(SAND 84-7103, 1984)

ONE LATERAL HOLE IN "HARD ROCK" (>10,000 PSI) CORED WITH WATER TO 800-900 FT (SAND 84-7103)

SEVERAL LATERAL HOLES CORED WITH DRILLING FLUID (MUDS OR FOAM) IN RAINIER MESA TUFFS TO ≥2000 FT IN SUPPORT OF WEAPONS TESTING.

FRAN RIDGE EXPERIENCE

CONCLUSION:

LATERAL CORING USING AIR FOR COOLING/CUTTINGS REMOVAL IN WELDED FRACTURED TUFF IS PRESENTLY BEYOND THE DRILLING STATE OF THE ART

VERTICAL AIR CORING IN WELDED TUFF USING THE ODEX SYSTEM HAS BEEN SUCCESSFUL TO DEPTHS OF ~300 FT

PROTOTYPE AIR CORING

PROJECT OPTIONS*:

1. UNDERTAKE R&D TO ASSURE LATERAL AIR CORING CAPABILITY TO LENGTHS OF ≥300 FT.

2. INCLUDE MORE DRIFT MINING TO ISOLATE LONG LATERAL HOLES FROM HYDROLOGY TEST LOCATIONS IN THE ESF

** 3. ELIMINATE LONG LATERAL COREHOLES FROM PLANNED TESTING-REPLACE WITH LONG DRIFTS TO THE EAST (BLOCK BOUNDARY) AND WEST (GHOST DANCE FAULT).

NOTES: *THE NEED TO AIR CORE SHORT (≤150 FT) HOLES REMAINS UNDER ALL OPTIONS

**THIS OPTION COULD HAVE SIGNIFICANT DESIGN IMPLICATIONS

PROTOTYPE AIR CORING
COST/BENEFIT TRADEOFF STUDY

INFORMATION NEED(S)	OPTION(S)	ORGANIZATION(S)
• DRIFT LENGTHS AND ORIENTATIONS	2 AND 3	USGS
• DRIFT ELEVATION(S)	2 AND 3	USGS,SNL;LANL
• CONCEPTUAL ESF DESIGNS AND COSTS	2 AND 3	LANL,F&S
• MAPPING/TESTING PLANS AND COSTS	2 AND 3	USGS,LANL
• DRILLING/TESTING PLANS AND COSTS	2 AND 3	USGS,LANL
• POST AND PRECLOSURE PERFORMANCE ASSESSMENT	1,2 AND 3	SNL,et al
• DESIGN IMPACT ASSESSMENT	2 AND 3	F&S,LANL,SNL
• SCHEDULE IMPACT ASSESSMENT	2 AND 3	ALL
• SAFETY ASSESSMENT	2 AND 3	F&S,REECO,LANL,DOE
• ENVIRONMENTAL IMPACT ASSESSMENT	2 AND 3	SAIC
• SITE CHARACTERIZATION ADVANTAGES	1,2 AND 3	ALL-(ESTP-C)
• SITE CHARACTERIZATION DISADVANTAGES	1,2 AND 3	ALL-(ESTP-C)
• MINING SUBCONTRACT IMPLICATIONS	2 AND 3	LANL,REECO,DOE
• VALUE OF PROTOTYPE HYDROLOGY TEST BED	1,2 AND 3	USGS
• VALUE OF GEOLOGIC DATA OBTAINED	1,2 AND 3	USGS,SNL(PA)

PROTOTYPE AIR CORING

RECOMMENDATIONS:

1. DEVELOP SHORT LATERAL HOLE AIR CORING CAPABILITY IN TOPOPAH SPRING TUFF

2. INITIATE IMMEDIATE COST/BENEFIT TRADEOFF STUDY FOR OPTIONS 1,2, AND 3

3. BASED ON RESULTS OF TRADEOFF STUDY

   - CONFIRM CAPABILITY TO CORE 2000 FT LATERAL HOLES IN TOPOPAH SPRING TUFF USING CONVENTIONAL FLUIDS
   - INITIATE TEST PLAN AND DESIGN MODIFICATIONS TO INCORPORATE OPTION 2
   - INITIATE TEST PLAN AND DESIGN MODIFICATIONS TO INCORPORATE OPTION 3

AIR CORING PROPOSAL

PURPOSE: DEVELOP AND/OR VALIDATE LATERAL AIR CORING TECHNOLOGY

APPROACH:

1. UNDERTAKE NECESSARY ENGINEERING R&D TO ADAPT ODEX SYSTEM

2. CONDUCT SHORT HOLE (≤150 FT) AIR CORING PROTOTYPE TESTS

DEPENDING ON TRADEOFF STUDY RESULTS

3. CONDUCT INTERMEDIATE HOLE (~300 FT) PROTOTYPE TESTS

4. CONDUCT LONG HOLE (~2000 FT) CONVENTIONAL CORING TEST

OR

CONDUCT LONG HOLE (~2000FT) AIR CORING PROTOTYPE TEST

AIR CORING PROPOSAL

TECHNOLOGICAL PROBLEMS– ALL AIR CORED HORIZONTAL HOLES

- INSERTION OF WIRE LINE SUBASSEMBLIES USING AIR
- TORQUE AND THRUST RIG REQUIREMENTS
- DUST CONTROL
- OPTIMUM AIR FLOW, BIT RPM, THRUST
- OPTIMUM BIT DESIGN FOR CORING/REAMING FRACTURED WELDED TUFF
- DETERMINATION OF PERTURBATION TO AMBIENT MOISTURE CONDITION OF ROCK

AIR CORING PROPOSAL

TECHNOLOGICAL PROBLEMS
INTERMEDIATE (~300 FT) HOLES

- SAME AS ABOVE, PLUS
- HOLE DEVIATION CONTROL
- DESIGN OF CASING GUIDES
- ANNULUS SEALING

AIR CORING PROPOSAL

TECHNOLOGICAL PROBLEMS LONG (~2000 FT) HOLES (AIR)

- SAME AS ABOVE, PLUS
- INCREASED HOLE DEVIATION CONTROL
- GEOPHYSICAL LOGGING (INSERTION METHODS, DATA LIMITATIONS, ETC)
- CUTTINGS REMOVAL (AIR FLOW REQUIREMENTS-PRESSURE, TURBULENCE, ETC.)
- CASING INSERTION
- PERSONNEL SAFETY

AIR CORING PROPOSAL

TECHNOLOGICAL PROBLEMS
LONG (~2000 FT) HOLES (CONVENTIONAL)

- OPTIMUM SYSTEM DESIGN
- DEVIATION CONTROLS
- CASING AND/OR HOLE STABILIZATION REQUIREMENTS
- FLUID LOSS (LIMITATIONS CRITERIA)
- GEOPHYSICAL LOGGING
- CASING INSERTION
- CUTTINGS REMOVAL
- PERSONNEL SAFETY

DRILLING COSTS

150 FT

ODEX 115 SYSTEM (150 FT)

150 FT 5½in. OD CASING @ $20.00/FT	$3000.00
150 FT DRILL STRING, SUBASSEMBLIES, ETC	$3850.00
CORE BITS 3 EA. @ $2625.00	$7875.00
GUIDE SLEEVES 15 EA. @ $900.00	$13500.00
COMPRESSOR RENTAL 5 DAYS @ $2520.00/DAY	$12,600.00
DRILLING CREW 5 DAYS @ $3000.00/DAY	$15,000.00
RIG RENTAL 5 DAYS @ $200.00/DAY	$1000.00
	$56,825.00
EACH ADDITIONAL 150 FT HOLE	~ $53,000.00

NO CONTINGENCY ADDED

DRILLING COSTS
300 FT

ODEX 165 SYSTEM (200 FT)	
200 FT 7 5/8 In. O.D. CASING @ $30.00 FT	$6000.00
300 FT DRILL STRING, SUBASSEMBLIES,ETC	$7700.00
ODEX 115 SYSTEM (300 FT)	
300 FT 5½in. OD CASING @ $20.00 FT	$6000.00
CORE BITS 5 EA. @ $2625.00	$13,125.00
GUIDE SLEEVES 30 EA. @ $900.00	$27,000.00
COMPRESSOR RENTAL 10 DAYS @ $2520.00/DAY	$25,200.00
DRILLING CREW 10 DAYS @ $3000.00/DAY(8 hour shift)	$30,000.00
RIG RENTAL 10 DAYS @ $200.00/DAY	$2000.00
	$123,025.00
EACH ADDITIONAL 300 FT HOLE	~ $115,000.00

NO CONTINGENCY ADDED

COST ESTIMATES FOR 500 FT

NOTE: COSTS ESTIMATED BELOW ARE BASED ON NEW PURCHASES OF CASING AND ASSOCIATED DOWNHOLE EQUIPMENT

500 FEET

ODEX 215 SYSTEM (FIRST 200 FT)

EQUIPMENT, 200 FT 10" DIAM. CASING (~$40.00/FT), 200 FT DRILL STRING	$50,000.00

ODEX 165 SYSTEM (400 FT)

EQUIPMENT, 400 FT 7 5/8" OD CASING (~$30.00 FT) 200 FT DRILL STING	$30,000.00

ODEX 115 SYSTEM (500 FT)

EQUIPMENT, 500 FT 5½" OD CASING (~$20.00/FT) 100 FT DRILL STRING	$12,000.00

CORING EQUIPMENT

CORE BITS 10 EACH @ $2625.00	$26,250.00
MISC.: SUBS, ETC.	$5,000.00
GUIDE SLEEVES 50 EACH @ $900.00	$45,000.00

COMPRESSOR RENTAL (30 DAYS)

1200 c fm X 250 PSI $2520/DAY	75,600.00

DRILL CREW (30 DAYS)

$3000.00/DAY (8 HR) X 30	90,000.00

RIG RENTAL (30 DAYS)

$200.00/DAY X 30 DAYS	$6000.00

TOTAL	$339,850.00

NO CONTINGENCY ADDED

COST ESTIMATE-HORIZONTAL CORING IN EXPLORATORY SHAFT (2000 FT)

ODEX 215 SYSTEM	
EQUIPMENT	$30,275.00
10" OD CASING, 700' $36.89/FT X 700'	$25,823.00
THREAD SAVERS, LIFT SUBS, SS BIT TUBE, DRILL TUBING (1500')	$36,500.00
ODEX 165 SYSTEM	
EQUIPMENT	$14,600.00
7 5/8" OD CASING, 1400', $26.07/FT X 1400'	$36,498.00
THREAD SAVERS, LIFT SUBS, SS BIT TUBE	$4,000.00
ODEX 115 SYSTEM	
EQUIPMENT	
5½" CASING, 2000', $20.00/FT X 2000'	$40,000.00
THREAD SAVERS, LIFT SUBS, SS BIT TUBE	$2,000.00
GUIDE SLEEVES 200 EA @ $900.00	$180,000.00
CORING EQUIPMENT	
HXB CORE SHOES, 20 EA @ $2625	$52,500.00
MISC. CORING EQUIPMENT	$5,000.00
COMPRESSOR RENTAL	
1200 CRM X 250 PSI, $2520/DAY X 90	$226,800.00
DRILL CREW	
3000/DAY (8 HRS/DAY) X 90	$27,000.00
RIG RENTAL	
ACKER DRILL, $200/DAY X 90	$18,000.00
	$943,996.00

NO CONTINGENCY ADDED

CONCLUSIONS / RECOMMENDATIONS

- THE PROJECT MUST DEVELOP THE CAPABILITY TO AIR CORE ≤150 FT HORIZONTAL HOLES IN WELDED TUFF

- THE PROJECT MUST EITHER DEVELOP THE CAPABILITY TO AIR CORE LONGER HORIZONTAL HOLES, OR DECIDE SOON TO INCORPORATE ALTERNATE PLANS

- PLANNING FOR PROTOTYPE TESTING OF SHORT (≤150 FT) AIR CORED HORIZONTAL HOLES SHOULD CONTINUE

- THE PROJECT SHOULD COMPLETE A COST/BENEFIT TRADEOFF STUDY (BY AUGUST) TO GUIDE DECISIONS ON LONG HOLE PROTOTYPE TESTING NEEDS

DRILL SPECIFICATIONS

ES AIR CORING	HORIZONTAL DRILLING
Hole Size - 10"	Hole Size - 37"
Hole Length - 2000 to 3000'	Hole Length - 600'
Chip Removal - Air with the possibility of water*	Chip Removal - Vacuum from the face into collection boxes and filters
Thrust -	Thrust - 1,500,000 lb
Power -	Power - Drill 125 hp Vacuum 200 hp
Liner - Requires an independent jacking operation	Liner - The liner is used as the drill string during drilling and is left in the hole as a liner

*This would require additional tanks and pumps

ES AIR CORING - PRINCIPAL TECHNICAL CONCERNS

MUCK (CUTTINGS) TRANSPORT

CUTTER PERFORMANCE

CONFINED SPACE CONSTRAINTS

CASING INSTALLATION

MUCK TRANSPORT

ES AIR CORING

- 300' MAY BE POSSIBLE
- WOULD REQUIRE VERY LARGE QUANTITIES OF AIR UNDER HIGH PRESSURE
- CHIP RETURN/DUST CONTROL SYSTEM MUST BE DESIGNED FOR UNDERGROUND USE
- COMMERCIAL DIAMOND CORE SYSTEMS DO NOT PROVIDE SUFFICIENT CLEARANCE FOR AIR AND CUTTINGS RETURN OVER LONG LENGTH

CURRENT EXPERIENCE

HORIZONTAL DRILLING

- THE VACUUM SYSTEM FOR THE HORIZONTAL DRILL IS EXPECTED TO USE 1500 CFM OF AIR FOR A MAXIMUM HOLE LENGTH OF 600 FT. AT A LOWER PRESSURE THAN FOR THE ES CORING
- FOR CHIP AND DUST CONTROL, A SYSTEM OF HOPPERS AND FITTERS ARE CONNECTED TO A 6" RETURN PIPE

CUTTER PERFORMANCE

ES AIR CORING

- BIT COOLING WITH AIR CORING COULD LEAD TO VERY LOW BIT LIFE WITH SUBSTANTIAL DOWN TIME FOR BIT REPLACEMENT

CURRENT EXPERIENCE

HORIZONTAL DRILLING

- THE BORING MACHINE USES THE DRY HOLE CONCEPT BUT USES BUTTON BITS FOR ROCK BREAKAGE AND REMOVAL AND THEREFORE DOES NOT GENERATE AS MUCH HEAT. FULL FACE CUTTING PROVIDES FOR MORE EFFICIENT BIT COOLING THAN DOES CORING.

CONFINED SPACE CONSTRAINTS

ES AIR CORING

- NEW EQUIPMENT WILL HAVE TO BE DESIGNED TO FIT IN THE CONFINED AREA.
- THRUSTING SUPPORT SYSTEM WILL HAVE TO BE DEVELOPED.

CURRENT EXPERIENCE

HORIZONTAL DRILLING

- MAXIMUM LENGTH OF DRILL STRING SECTIONS WILL BE 8 FT REQUIRING A 25 FT OPENING FOR SAFE AND EFFICIENT OPERATION.

CASING INSTALLATION

ES AIR CORING

- INSTALLING CASING DRY COULD CAUSE DIFFICULTY; NORMALLY CASING IS INSTALLED WITH SOME TYPE OF LUBRICANT (BENTONITE, ETC.).
- IN THE HORIZONTAL MODE, THE LINER COULD BECOME LODGED IF ANY ROCK DISLOCATES FROM THE ROOF PRIOR TO LINER INSTALLATION.

CURRENT EXPERIENCE

HORIZONTAL DRILLING

- THE LINER FOR THE HORIZONTAL DRILL ACTS AS THE DRILL STRING AND IS THEN LEFT IN THE HOLE. SUFFICIENT CLEARANCE IS ALLOWED BETWEEN THE LINER AND HOLE WALL SO NO LUBRICANT IS REQUIRED.

POTENTIAL ALTERNATIVES

° WET DRILLING	- SIGNIFICANT POTENTIAL FOR FLUID LOSS TO THE ROCK - WET DRILLING COULD INCREASE BIT PERFORMANCE AND LIFETIME - MUD HANDLING OPERATIONS COULD BE SUBSTANTIAL - SOME TECHNOLOGY DEVELOPMENT/DEMONSTRATION REQUIRED
° MINING	- AVAILABLE TECHNOLOGY BUT REQUIRES ADDITIONAL VENTILATION - BLAST DAMAGE COULD COMPLICATE SITE OBSERVATIONS - VISUAL INSPECTION AND LOCAL CORING POSSIBLE
° TUNNEL BORING MACHINE (TBM)	- AVAILABLE TECHNOLOGY BUT REQUIRES ADDITIONAL VENTILATION - LEAST DISTURBANCE TO THE ROCK SURFACE - VISUAL INSPECTION AND LOCAL CORING POSSIBLE

RECOMMENDATIONS/ACTION ITEMS

STOP ALL CONSIDERATION OF AIR CORING FOR DISTANCES >100 FT

IMPOSSIBLE TO PROMISE A 3000 FT CAPABILITY BY TIME NEEDED IN ES

BY AUGUST 1

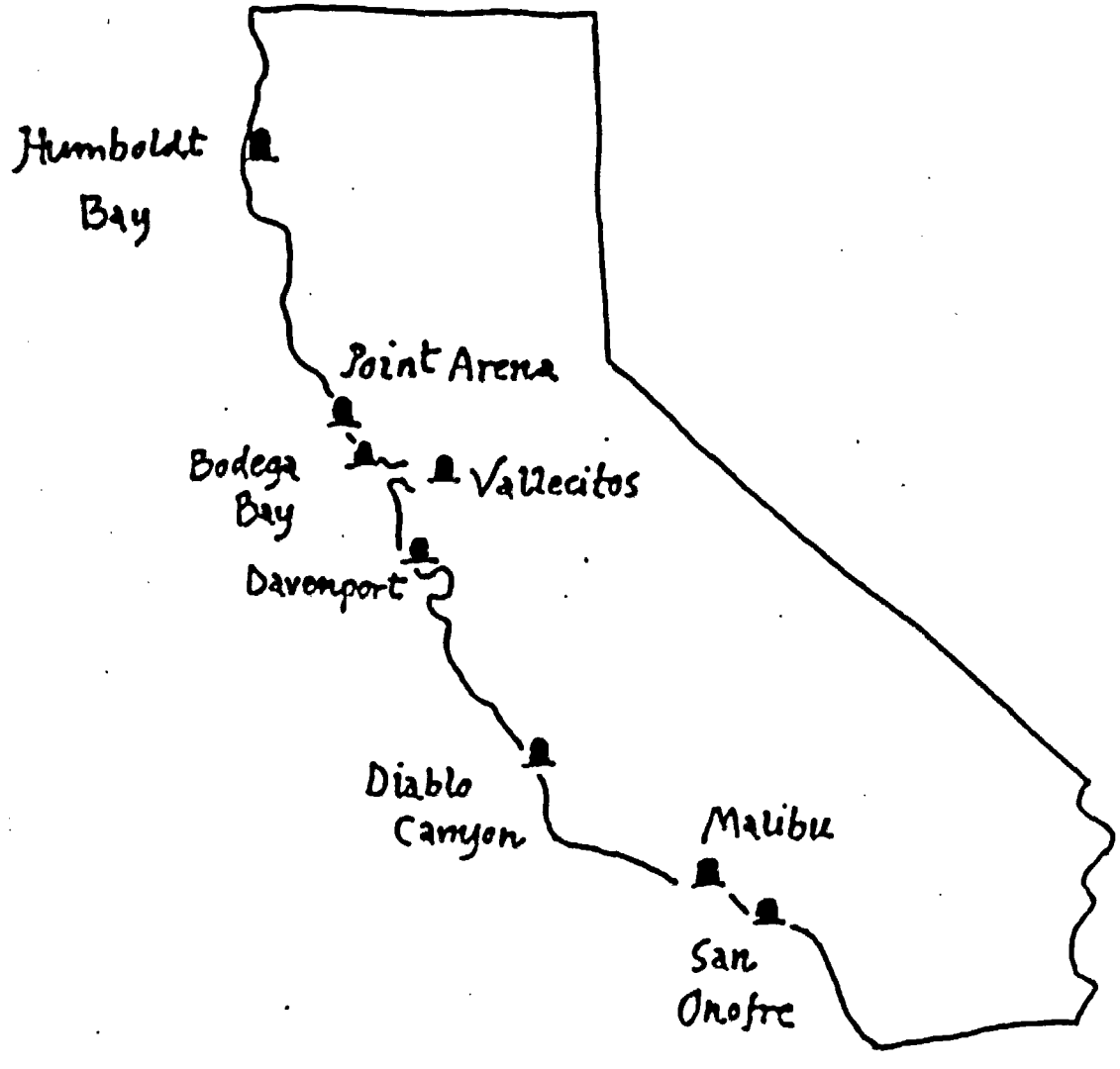
- QUANTIFY STAND-OFF REQUIREMENTS FOR HYDROLOGIC TESTS AND NECESSITY FOR LONG HORIZONTAL HOLE IN CALICO HILLS (USGS OR SNL PA)
- OBTAIN COST ESTIMATES, DEVELOPMENT REQUIREMENTS, AND COMPLETE TRADE-OFF BETWEEN WET DRILLING, MINING, AND TUNNEL BORING MACHINE OPERATION (LANL AND SNL)
- EVALUATE ES OPTIONS FOR ACHIEVING REQUIRED STAND-OFF, MUCK REMOVAL, VENTILATION, AND DRILLING POWER

BY SEPTEMBER 1

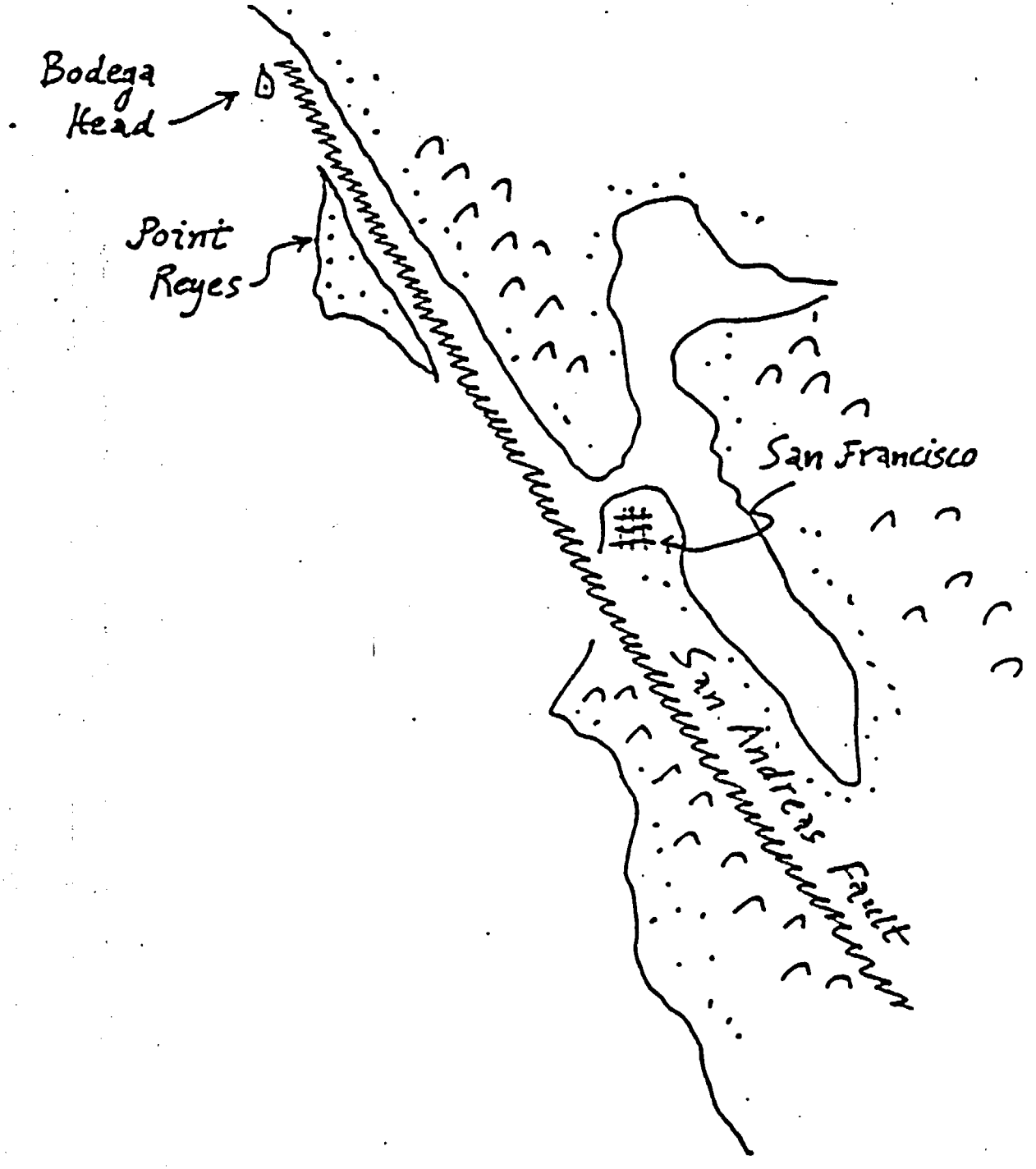
- DOCUMENT DEVELOPMENT/DEMONSTRATION REQUIRED FOR SHORT-HOLE (>100 FT) AIR DRILLING
- SELECT EXPLORATION METHOD FOR "LONG-HOLE" INVESTIGATIONS AND DOCUMENT DEVELOPMENT/DEMONSTRATION REQUIRED

GEOLOGY IN LICENSING

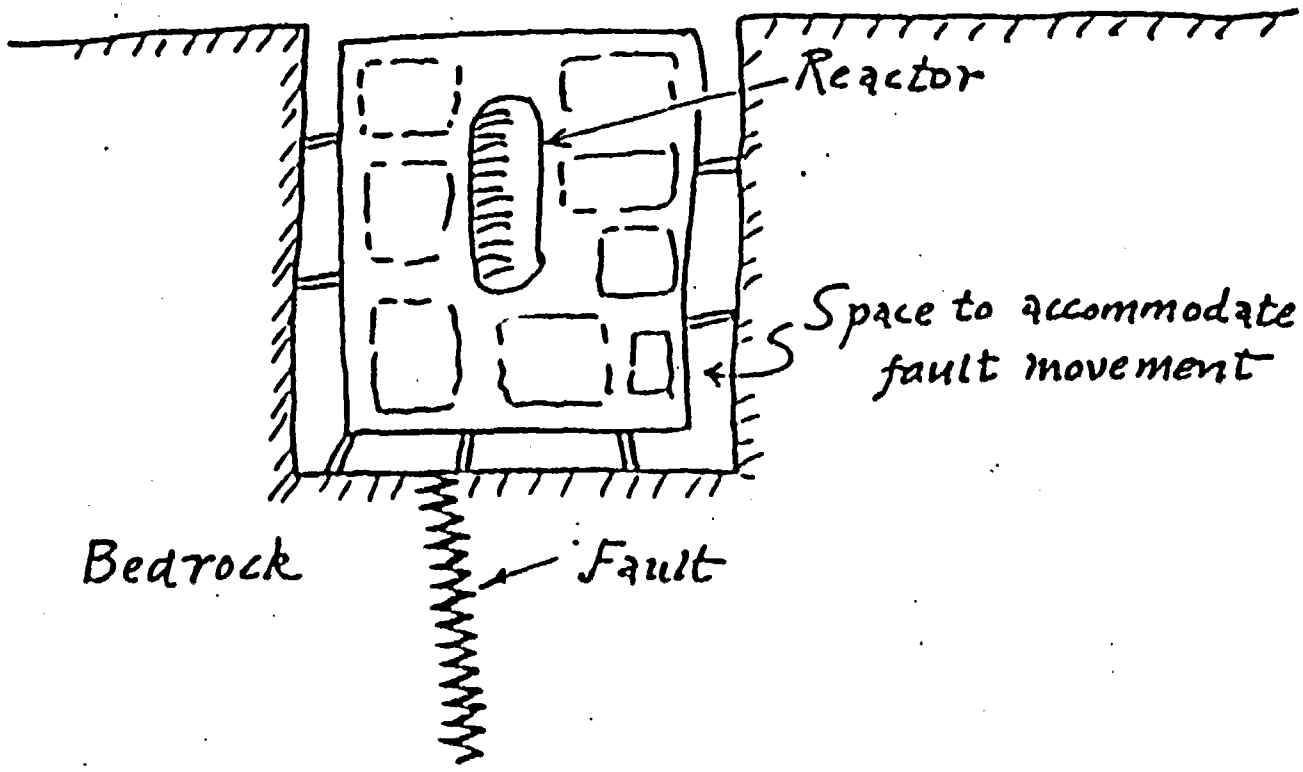
NUCLEAR FACILITIES



Actual and proposed California nuclear power plant sites



Bodega Head location map



PG and E's proposed fault-proof design at Bodega Head

Few places on the earth are exposed to more certain earthquake risk than are those along the San Andreas fault in northern and central California. The case arguing the safety of the Bodega Head site rests largely on the confidence that "granite" is a good foundation material and that it minimizes ground shaking due to earthquakes and on the judgment, supported but not proved by geologic investigations of Bodega Head, that no faulting has occurred there during the past several thousand years. The case against the site stresses seismology's lack of detailed information on events and conditions in the epicentral tract of a major earthquake. Because we cannot prove that the worst situation will not prevail at the site, we must recognize that it might. Acceptance of Bodega Head as a safe reactor site will establish a precedent that will make it exceedingly difficult to reject any proposed future site on the grounds of extreme earthquake risk.

It is hoped that this review will illustrate the tenuous nature of some of the scientific judgments that must be made, these judgments then serving as the body of "fact" on which the engineering design of the plant will be based. The primary difficulty is that the seismologist is called upon to make judgments that require large extrapolations beyond his personal professional experiences and even beyond those of the science he serves. When such seismological judgments are shorn of qualifications and condensed to a convenient statement for engineering guidance, they take on an unwarranted ring of certainty that belies their shaky foundations. The thread of responsibility is broken at this step, the seismologist believing that he has handed it to the engineeer, who reasonably feels that it remains with the seismologist.

The Geological Survey concluded that "...even given the most careful execution of the exploration program as outlined and the most favorable return of data for efforts expended, there would remain certain areas of inadequate coverage and certain residual indeterminacies which would preclude final evaluation of the site with the degree of conservative assurance normally required for such applications." ⚒

10 CFR 100

"REACTOR SITE CRITERIA"

APPENDIX A

"SEISMIC AND GEOLOGIC SITING CRITERIA FOR NUCLEAR POWER PLANTS"

The history of AEC/NRC criteria for siting nuclear power plants on or near faults follows:

February 1956
"No facility should be located closer than one quarter to one half a mile from the surface location of a known active earthquake fault."

May 1959
"The earthquake history of the area in which the reactor is to be located is important . . . a site should not be located on a fault."

April 1962
One quarter to one half a mile exclusion changed to one quarter mile.

1966–1969
Development of siting criteria eventually incorporated in 10 CFR 100, Appendix A.

Appendix A published for public comment.

November 1973
Appendix A adopted. Defines "capable fault as having moved once in 35,000 years or recurrently in 500,000 years; or being associated with 'macroseismicity'; or associated with other capable fault."

April 1979
Publication of SECY-79-100 Information Report, critiquing Appendix A.

NUCLEAR FAULTING - DISPLACEMENT

BODEGA HEAD
MALIBU
DAVENPORT
POINT ARENA
NORTH ANNA
HUMBOLDT BAY
VALLECITOS
SATSOP

NUCLEAR FAULTING - VIBRATORY GROUND MOTION

DIABLO CANYON
INDIAN POINT
SAN ONOFRE 2/3
TROJAN
HANFORD
SKAGIT
PEBBLE SPRINGS
CENTRAL U.S. PLANTS
EASTERN U.S. PLANTS

APPLICANTS

AEC/NRC

ACRS

USGS

USCGS

INTERVENORS

OBSERVATIONS

1. GEOLOGY IN ADJUDICATED PROCEEDINGS

2. PRECISE (FACTS) VS IMPRECISE (JUDGEMENT)

3. 4.5 BILLION YEAR HINDSIGHT VS 100 - 10,000 YEAR FORESIGHT

4. NEED FOR PROBLEM DEFINITION BEFORE ATTEMPTING SOLUTION

5. NEED TO FOCUS ATTENTION ON SOLUTION TO PROBLEM DEFINED

6. NEED FOR REACHING A DECISION WITHOUT ALL THE "FACTS"