See Pocket 2 of 3
for enc.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 85/129

'85 MAY 31 A10:58

MAR 26 1985

WM Record File 106.2 WM Project 16
Docket No.
PDR ✓
LPDR ✓
Distribution:
R Johnson J Linehan
(Return to WM, 623-SS)
To: R Johnson

Comments—EA
U.S. Department of Energy
Attn: Comments-EA
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Sir:

The Department of the Interior has reviewed the draft environmental assessment (EA) for the Davis Canyon site.

Our comments (attached) support the Department of Energy's (DOE) proposal not to nominate the Davis Canyon site as a preferred site for characterization. We agree with the DOE's preliminary determination that this site does not offer a combination of characteristics and conditions which would be most advantageous to the successful development of a nuclear waste repository. In addition, our comments contain substantial information regarding the likely adverse effects from site characterization and repository development on Federal lands in the Paradox Basin including, in particular, Canyonlands National Park. We believe that the information and concerns raised in our comments provide additional support for DOE's preliminary decision not to recommend this site for characterization. In addition, when the information we have provided is incorporated into the final EA, the DOE will be able to readily conclude that this site is not suitable for the location of a nuclear waste repository and should, in fact, be disqualified from further consideration.

Our detailed comments are attached.

Sincerely,

Bruce Blanchard, Director
Environmental Project Review

Enclosures

106.2

Encl. to ltr. to DOE from B. Blanchard 3/28/85

General

The opportunity to comment on the draft Environmental Assessments (EAs), the nine candidate sites for the first repository for civilian high-level radioactive waste is appreciated. These large, complex reports represent a meaningful contribution in terms of effort and time. The effort of preparation was obviously large, and available time was short, which might very likely have contributed to some significant shortcomings of internal consistency in the reports. There apparently was little time or manpower devoted to the cross checking of values or descriptions within individual reports. Since the time available for review and comment was also short, research of the background reference documents was not possible. Thus our reviews are necessarily based on the knowledge and experience of individual reviewers, bureau experience and expertise, and the content of the draft Environmental Assessments. Also, our experience at each of the candidate sites is vastly uneven, and the review comments reflect this unavoidable variation.

Three related basic issues that became apparent during our review of the EAs are (1) the modeling of hydrologic systems, (2) the identification of failure modes and the most likely pathways of radionuclide release, and (3) conclusions reached in the EAs are not supported by the data base. In regard to modeling assumptions, reliability of data, and limitations of results of the modeling of hydrologic systems should be better described. Such descriptions might help explain apparently inconsistent ground-water travel times given in different sections of the salt-site EAs as is noted in the specific comments.

The failure modes addressed in the EAs are simplistic. We are particularly concerned that all available geotechnical information available for the various host rocks apparently has not been used to assess the mechanical and thermal responses of the geologic and hydrologic systems to the repository. This is particularly true with regard to the sites where the host rock lies below the water table. The possibility that a response of these systems to a repository might be the opening of vertical pathways for fluid circulation is dismissed either summarily or by means of a partial and theoretical analysis. Probable flow paths from the repository frequently are determined on the basis of inconclusive data on head gradients, on restrictive assumptions on the nature of water-bearing zones, and on flow directions through salt units determined by the unsupportable assumption of Darcian flow through a uniformly saturated and homogeneous porous medium. In general, the conclusions of the EAs as a body appear to go well beyond what the data base justifies. Confidence in the objectivity of the reports will be enhanced by conservation, and demonstrated by closer adherence to what the data base can support. Conclusions are supported with little data in many instances. For example, values for effective porosity and dispersion are necessary to calculate radionuclide transport. Field measurements of those parameters are rare, yet calculations are made as if sufficient data were in hand.

We recommend the EAs should contain a comprehensive discussion of the schedule for various activities related to characterization and nomination of a site. The reviewer must understand what activities will be undertaken concurrently; those activities that will be phased; how review of completed studies will be undertaken; a description of the

intermediate decision points in the characterization phase; and how sites being characterized will be evaluated during this process. We believe this important information is needed in the final EA to ensure that sites with presently unknown flaws could be eliminated from further study during the characterization phase. The discussions in Section 4, Expected Effects of Site Characterization Activities, should incorporate this information.

To address chapter 7 adequately requires not only solid, broad-scope technical experience but also an awareness of the needs, goals, and guidelines applied to The Civilian Radioactive Waste Management Program. Chapter 7 is being reviewed here as a unique element since the same text for this chapter appears in each EA. The results are presented separately and not in site-specific terms.

We have two concerns about the ranking system used: (1) the comparison uses different kinds of data, different qualities of data, and different distributions of data, assembled and evaluated by different teams for different kinds of sites; and (2) the ranking scheme which treats all issues of equal value does not seem to be fully defensible, because all concerns are not truly equal in isolating high level radioactive waste.

With regard to the first concern, it is unclear why sites, for which many geotechnical studies have been completed, have been compared to sites for which comparable studies do not exist. Generally, further investigation of a phenomenon, topic, region, etc., reveals increasing complexity over what had previously been described; also, even major new findings often accompany further studies. Therefore, in all likelihood, were the Richton, Deaf Smith, and Davis Canyon Sites as extensively studied as the Hanford and Yucca Mountain Sites, they might not appear as "favorable" in the analyses as the sparse data suggest. Accordingly, some ranking "penalty" probably should be assigned to these sites (Richton, Deaf Smith, and Davis Canyon) in both post and preclosure rankings prior to attempting a meaningful comparison with the Hanford and Yucca Mountain Sites. In addition, a) we wonder if the facts are accurate and complete as stated, b) whether the facts are correctly used and inferences based on them are correctly drawn, c) whether these facts and inferences are correct and fairly summarized and transferred from one chapter to another and into Chapter 7 in particular. We have noted many deficiencies during our review. Some of these deficiencies, such as unsupportable assumptions on ground-water flow provide key input for the rankings in Chapter 7. Accordingly, many of the rankings in Chapter 7 become questionable and may even be in error. Therefore we recommend Chapter 7 should discuss the effect of differences in the data bases among the sites in the comparable analysis. Such a discussion certainly is needed.

Furthermore, the EA's taken as a body are very uneven in treatment of available data. This is understandable to a degree, because each of the site EA's was prepared by a different team of experts describing sites that very considerably in physical characteristics. This unevenness introduces difficulties for the authors of Chapter 7 when using an "equal weight" decision process. There is a need to establish some common framework or operational procedure to obtain some comparability of facts for the sites. This may be approached by assignment of an "important factor" or a weighting to each of the elements of a site (such as elements of ground-water hydrology, tectonics, geochemistry).

Our second concern is that the comparative analysis in Chapter 7 does not adequately weight the favorable and potentially adverse conditions by their importance. Preclosure and postclosure factors are weighted virtually the same (49:51). Mistakes during construction and operation can, at least in principle, be corrected, but postclosure failures are unlikely to be remedied. Within each group of guidelines, the favorable and potentially adverse conditions are weighted equally. There is such a long list of different conditions that a condition of singular importance for one site receives no particular attention. The comparative analysis resolves into a vote-counting numbers game, as if each vote had the same importance, which is definitely not the case.

We recognize that a system of weighting is not easily created and the weights assigned to different conditions will be questioned. It is unclear whether any effort was made to evaluate an approach, as follows. For each of the sites determine an "importance factor" for each of the elements or characteristics of the site that must be used in the comparative analysis. These provide an initial basis for weighting the favorable and potentially adverse conditions individually for each site. As these weighting factors are necessarily judgmental, we recommend that various combinations of weighting factors be applied to determine if a consistent sequence of site rankings can be obtained. The use of Monte Carlo methods should be considered in this evaluation. If such a weighted evaluation process has not been attempted, we recommend that it be tried to determine whether or not the rankings remain stable when individual criteria are weighted. Another approach which would have merit in confirming the rankings would be to impanel a Delphi group. Both of these processes would tend to create a more defensible objective analysis of the sites, ultimately recognizing that subjective judgment is required to reach any ranking, no matter what method is employed. Therefore, we question the grades assigned in the Tables in Chapter 7 of each EA. We believe the addition of a U grade for unresolved would have better identified grey areas and urge this be considered in the preparation of final EAs. The following detailed comments on Chapter 7 point out examples where incorrect comparisons of site characteristics might have been made.

For example it is unclear how the "P" and "NP" scheme of table 7-1 furnish a basis for comparison. The data source for the table should be identified. We question the summaries entered into table 7-1 and others like it. For example, the trustworthiness values for some of the geohydrologic parameters for any of the sites based on preliminary results of studies to date should be presented. It is also unclear whether the benefits of the saturated versus the unsaturated zones have been compared.

Examples of concerns include Page 7-10, paragraph 1—On geohydrology, specifically on travel time to accessible environment, comparison for different sites: Very different data abundance, type of data (model, drill stem test, well data, etc.); different sites may have used different models and perhaps different factors for the margin of "conservative" safety allowance (this factor is cited as 10 for Hanford and Yucca Mountain for specific parameters, but may not be for others. We question whether a single PROSPECTOR type model can be used for all sites. For Richton Dome, travel time is apparently based on a stable and stationary salt dome. Possible diapir movement is covered under "favorable condition no. 2" of the comparison chart. For Richton Dome this criterion rates a P, favorable, but nothing is said about diapir movement.

Favorable condition no. 3 (page 7-12) is rated NP for five sites, but the treatment is much too brief. Here, with the admitted uncertainties, lie possible problems; the nature of the uncertainties and the likelihood of their resolution by preshaft studies and later shaft-based studies should be projected.

If only one of the four subconditions for favorable condition no. 4 is rated positive, the entire condition no. 4 is rated positive. It is unclear whether the four subconditions are of equal weight. We believe the rankings may not be the same for different types of host rock and hydraulic conditions. We recommend the expected flux be a factor in assessing the sites not withstanding the footnote on page 7-15. The assessments should address these issue.

By summarizing and ranking subcategories, such as geohydrology, possible interaction among the major factors (such as hydrology vs. geochemistry) is not considered. This problem must be addressed in the final assessment.

Geochemistry—Favorable condition no. 1—Concerning redox conditions of the sites—again we are faced with disparate bases of data and different uncertainties. The presence of methane and pyrite, etc., may not be pervasive, for instance.

Favorable condition no. 2—Discussion for Hanford concerns reducing conditions but for the other sites the condition is for sorptive properties of the matrix material. Sorptive property of host rock at Hanford is low. We do not understand how these distinct properties can be equated. Once rated, the basis becomes obscured and the reader/user is apt to accept the ratings as on a basis of commonality.

Favorable condition no. 3—Again, the same problem of how to (1) evaluate the individual factors, (2) rate their role for each site, and (3) compare among the sites, remain significant.

Favorable condition no. 4—Limiting release to less than 0.001 percent per year—is rated P for all sites. The bases are different—for all but Hanford it is the absence of water at the waste package; for Hanford it is the presence of reducing condition; high pH, and reduced corrosion of metal overpack (page 7-20). These are different factors, with different reliability. We also recommend the assessments investigate the availability of geochemically compatible and feasible backfills for different kinds of media.

Rock Characteristics (postclosure)—This factor should be prefaced by a statement of the expected magnitude of the thermal pulse for proper evaluation. This important consideration has been omitted. Possible changes in the geologic framework and hydrologic system as a result of the heat load from the emplaced waste should be given intensive attention in future studies. Attendant uncertainties should be explicitly explained in the final assessments. In particular, possible changes in ground water circulation and flowpaths, fracture development, aperature changes of existing fractures, hydrothermal alteration of rock, and vertical and horizontal movement of the rock and land surface should be addressed.

Not just the geohydrology but other properties, specifically postclosure rock characteristics, vary directly as the result of differences between saturated and unsaturated zones. Yet other than in the section on Geohydrology, the differences for these two types of sites are not clearly spelled out (an exception is the recognition of sealing by ductility, page 7-25).

Potentially adverse condition no. 1—It is unclear how the possible stability problem at Hanford is not expected to affect the containment capability. The document states this on page 7-25 without citing the basis for the conclusion.

In the ranking summary section, the possible importance of "potentially adverse condition no. 2" is not given thorough treatment. The possible brine migration effect is allowed in the discussion under that heading, but without apparent justification other than the statement that "these phenomena are not expected to have significant effects at any of the sites," dismissed in the summary discussion. Further, the report states that the salt sites are rated higher because of lack of significant adverse properties. Both statements directly contradict the earlier, more specific discussions. This discrepancy must be investigated and supported.

As stated earlier, the question of developing weighting factors cannot be overemphasized. The almost unmanageable list of different conditions (favorable, potentially adverse, etc.) almost dictates that any single item on the list runs the risk of being forgotten. Thus it appears to become a numbers game with vote counting, as if each vote has the same importance. However, this is manifestly not so. An adverse condition on brine migration in salt should have overwhelming importance if it is present; a corresponding overwhelming factor for basalt might be the postclosure hydrology. The present report completely overlooks these partly judgmental factors. As a result, we believe the rankings might be unrealistic.

Potentially adverse condition no. 1—We question whether the following factor is worth worrying about. If precipitation and runoff rise significantly in the next 100,000 years, could new perched aquifers be created in what is now the unsaturated zone? If so, and if the repository shaft passes through this new aquifer, that could be a cause for concern.

Erosion—Favorable condition no. 3 is readily the important one. As long as the waste is unlikely to be exposed, the primary function of the repository will be fulfilled, thus the other two are insignificant. They merely help to ensure that condition no. 3 is fulfilled in the absence of more direct data. The three conditions are not equal and should not be so listed or compared.

Favorable condition no. 1—Could be rated NP (as is the case for NTS), but if the site is one of depositional aggradation, then it should not pose a problem (may pose one in case of rapid deposition, if a particular horizon is thereby pushed down into the underlying water table; if this should be a topic of concern, it isn't discussed).

Favorable condition no. 2—Wording could, in combination with condition no. 1, be construed to mean that erosion at Hanford during the next 10,000 years could amount to 450 m.

Potentially adverse condition no. 1, page 7-35—This reference to deposition during the last glacial period implies changes in hydrologic conditions resulting from climate effect. Under the latter heading, the only reference (page 7-31) refers to "changes" without any specifics. Taking these two entries together, could imply there's more to the story, for instance infiltration of ground water and resultant changes in permeability, sorptive properties (due to different material in fractures), flux, etc.

Qualifying conditions—The reason for making the qualitative distinction between Hanford and the other sites is not obvious; this point accents the concern about the basis for comparison among the sites.

Dissolution—Potentially adverse conditions and favorable conditions—the presence of breccia pipes, etc., at the three salt sites being conceded, the important task should be to ascertain the age of these activities. Right now the responses given to the two issues above for the three salt sites are not consistent.

Tectonics (postclosure)—Potentially adverse condition no. 1. Diapirism was included in the listing, but no evaluation was given for the salt sites. This might affect the ranking.

Human Interference—No more than passing mention of artificial markers. Are there any site-specific factors affecting the use of artificial markers?

Potentially adverse condition no. 1—What are considered as resources today may not be what people will seek in 5,000 years. Think of oil or coal in the pre-Marco Polo western world, or rutile, or uranium, or bauxite (or, in the foreseeable future, anorthosite). Our present conception of resources is no reliable guide for future explorers. Also, we believe the proximity to a National Park is a significant factor that should be considered under this heading.

Postclosure Systems Guidelines, Pages 7-53 and 7-54—No mention is made of whether the same waste form is assumed for all the sites, or whether waste forms and waste packages are tailored to the sites. We believe one should assume that the decision made in 1984 on the once-through uranium cycle, without reprocessing, will be valid in 20 years. Assessment of the qualifications of sites for use sometime in the 21st century probably should include the option of disposal of reprocessing waste, both hot and cool. Therefore, the assessment is thus quite uncertain and the site comparison may be prejudiced. Page 7-54 states that the waste packages are expected to last "indefinitely." This assumes a dry repository. Possible brine migration or possible electrolytic reaction of waste with water has not been considered. In the EA report for Davis Canyon, the authors mention (pages 6-92 and 6-93) 25 and 8 liters of brine accumulation per emplacement for cooled high-level radioactive waste and for spent fuel rods, respectively, in 100 years, and conceded that "...the presence of brine is expected to cause some corrosion of the waste cannister." Surely, such factors could and should be given thorough consideration and not merely be counted as a vote.

Radiological Hazards, Favorable condition no. 1, population density should address transient populations. For example, this factor might affect the density for Davis Canyon.

Site Ownership and Control—The rankings seem highly artificial to us. Other than top-ranking Hanford, we cannot agree with the priorities. An Act of Congress is required to transfer lands controlled by this Department. We question the success of a process of eminent domain.

Meteorology—This discussion is an example of the comparison (admitted by the authors of the report) of different kinds of data or absence thereof. The sites cannot be ranked on this basis.

Cost—It is not clear whether the cost includes the construction of transportation facilities to the sites and special transportation vehicles. This cost category is not listed under either "construction" or "operation." Transportation costs may vary greatly among the sites.

Format

Topics are difficult to follow because data and interpretations commonly found grouped in a technical report by discipline are scattered throughout several chapters. This is especially notable for geologic and hydrologic matters. Summaries of individual disciplines should be presented thus facilitating a more complete understanding of what is known and what must still be discovered. Alternatively, a detailed index in the final EA could help alleviate the problem. One or the other is necessary for a meaningful exposition of what is known.

As a basis upon which to develop some perspective on the overall quality of presentation, one report, Swisher site, was scanned intentially for internal consistency. This exercise revealed literally hundreds of inconsistencies and contradictions. If this report is representative of the entire group, the Environmental Assessments need a greal deal of hard work before final release. Details of this scanning effort are not provided. But they could be made available upon request should they be considered of value later.

In the interest of utility and effectiveness of the document, the reader should not be required to turn each assessment more than 90° in order to read the material. Some tables are upside down requiring a turn through 180°. It is also possible to find an illustration oriented with words right side up only to find a table on the next page printed upside down. Illustrations and tables in this text should be identically oriented.

Paradox Basin

There are some major omissions in the appraisal of tectonics in the Davis and Lavender sites. First of all the sites are located on the margin of a major tectonic element, the Monument Upwarp. This uplift is over 100 mi long and has about 5,000 ft of structural relief on the Leadville Limestone. Most of this uplift took place during the Laramide orogeny, but the complete tectonic history is poorly known. A more lucid and definitive appraisal of this important tectonic feature is needed. Another notable omission is the lack of gravity and aeromagnetic maps and their interpretations. We can only guess about basement discontinuities etc., when this kind of data is absent. It was stated in the report that the repository horizon (Salt 6) is expected to be about 200 ft thick at the Davis Canyon site, and that there are no potentially adverse conditions that would impair the flexibility of selecting the depth, configuration, or location of the facility. At the GS-1 location, Salt 6 contains a thick zone of carnallite-bearing halite. This is underlain by about 85 ft of carnallite-free halite, which is being considered as the construction interval. The regional dip at the Davis Canyon site is about 210 ft per mi, and it is quite probable that the carnallite zone will be present. If the canister hole plus room height equals 40 ft and buffer zones of 20 and 39 ft are needed above and below this, then there may be construction problems because some gentle low-amplitude folding superimposed on the regional dip at the Davis Canyon site would be anticipated. In all likelihood, this could bring either the carnallite zone above or the interbed below into the mined area. Therefore, even though Salt 6 may be at least 200 ft thick at the site, there is no assurance that the stated "flexibility" exists.

The evaporite sequence at the Davis Canyon site is associated with large amounts of organic matter (kerogen), which have already generated some hydrocarbons and are capable of generating much more. The EA does acknowledge that gassy conditions might be encountered but suggests that this is no great problem. The potential impact of these conditions is probably much greater than suggested. Salt 6 is overlain by an interbed that includes about 42 ft of dolomitic mudstone that is rich in kerogen. This kerogen is submature, which means that with additional heating (waste emplacement), it will generate appreciable amounts of new hydrocarbons. Most of the hydrocarbons generated during the burial history of the Paradox Formation are still in place because of the effective evaporite seals. As a result, the organic-rich units are generally overpressured. With additional heating, overpressuring may increase, and this should be an important factor to consider under both preclosure and postclosure conditions.

Screening criteria—The distinction between "bedded salt" and "dome salt" creates an anomaly in connection with the screening method used in the Paradox Basin. This arises because the entire Paradox Basin has been classified as a bedded-salt area. Therefore, the pillow shaped salt diapir in Salt Valley is excluded from further consideration because of the mapped surface faults in the Mesozoic strata, which flank the diapir. However, the faults on the flanks of the Salt Valley anticline, which are the result of both upward movement of the evaporitic mass and collapse where salt dissolution has taken place, are no different than the faulting associated with all salt domes in the Gulf Coast area. According to Brunton, G. D., et al., 1978, the "...screening specification for this criterion

is that no regional tectonic faults shall be apparent within 3 miles (mi) of the center of a candidate salt dome." The internal structure of the salt core of the Salt Valley diapir is admittedly complex, but it is no different in that regard than any Gulf Coast dome. The only real difference is the presence of the thin nonhalite units, and as yet neither the Office of Nuclear Waste Isolation nor DOE has ever indicated that this was a construction liability.

Fluid movements in salt—Darcian flow through salt units is assumed for purposes of ground-water travel time calculations, determination of most likely flow paths to the accessible environment, and performance modeling. Hydraulic gradients in salt units are calculated in the environmental assessments as if hydraulic heads in adjacent hydrologic units were dissipated across the salt units. Flow velocities through the salt units are calculated using permeabilities inferred from regional ground-water flow models or measured on core samples.

Because salt is a plastic medium, the assumption of Darcian flow is unreasonable. Other driving forces such as rock stress and temperature are more likely to produce fluid movement. Hydraulic heads in hydrologic units separated by a salt unit cannot be related through a hydraulic gradient across the salt, as if the salt was a porous medium. Permeability estimates of salt units from the gross regional ground-water flow models are suspect, as are laboratory permeability measurements made on core samples that were subject to in situ conditions not duplicated in subsequent handling and analyses.

We acknowledge that the assumption of Darcian flow through salt is a conservative analysis as far as calculating the magnitude of flow velocities in the salt. However, inherent in this assumption is that ground-water gradients define the direction of the most probable pathway of radionuclide transport through the salt. On the contrary, pathways through the salt are most likely to be determined by differential stress, both in situ and resulting from effects of the repository, temperature, and other possible failure models.

Salt storage piles—A potential environmental impact at each of the salt sites is the presence of extensive salt storage piles. The assessments assert that any deleterious effects at these piles can be mitigated, but this conclusion is not based on in-depth analysis. Important to the conclusion is the assumption that a crust will form at the surface of the salt and provide protection from dissolution and erosion. Operating experience and/or theoretical studies should be cited to demonstrate that such a crust will form and would be effective under the specific climate conditions at the various salt sites.

A liner beneath the salt pile will be relied upon to provide long-term protection for ground water. A review of past and ongoing experiences where such liners have been used, including an evaluation of their effectiveness and the length of their useful life, should be conducted. We are not aware of any practical experience with such liners for the time periods of decades involved here. Any leachate through the liner is assumed to have total dissolved solids (TDS) of 35,000 parts per million (ppm). However, concentrations 10 times this value seem entirely possible.

Davis Canyon

We are concerned about the rankings of sites for each technical guideline in the Postclosure set (EA page 24) because Davis Canyon is shown in the top ranking for geohydrology. We question this conclusion for the following reasons 1) the ground water model does not and cannot account for secondary permeability in fractures, joints, and faults; 2) the many dissolution geologic structures around the proposed site indicate a high potential for hydraulic mobilization of salt; 3) the final disposition of 10 million tons of excavated salt presents another salinity hazard to the Colorado River; (4) even a hydraulic flow path change which resulted in 1 ft^3/s interaction with the Paradox salt beds conducting salinity to the Colorado River could potentially have very significant salinity impacts; and 5) uncertainty of radiological containment and risk of impact to the Colorado River are greater than the present technological capabilities to adequately characterize this geohydrologic setting.

Rock characteristics—The EA states that both thermal expansion and salt creep will occur, and would be sufficient to cause a 1 meter uplift at the surface near the Davis Canyon site with significant fracturing in the overburden. Such fracturing could change ground water flow paths resulting in salinity impacts to the Colorado River. The assumption that energy from thermal expansion in the salt would be expended by local uplift may not be correct. The salt and overburden rock reaction to the combined effects of thermal expansion, thermally induced plasticity of the salt, differential loading, and potential movement along geologic zones of weakness cannot be predicted with present models.

Local geologic dissolution structures, salt piercement domes, collapsed anticlines and breccia pipes are inadequately understood in relationship to time, climate, dissolution rates and environment of deposition. This and the difficulties in modeling noted above raise the question of whether the characterization will permit sufficient understanding so as to assure protection of Colorado River water quality.

The site is a natural salinity hazard to the Colorado River. Construction and thermal loading could exacerbate the situation. The EA graphically demonstrates potential impacts in Figure 3-18, page 3-39. Postclosure thermal expansion fracturing, salt plasticity, induced salt creep, and dissolution are possible threats to Colorado River salinity and possibly to radiological contamination as well.

Natural Resources—Davis Canyon is ranked third out of five groupings, however, the Colorado River is not considered a valuable natural resource in the EA. Since the Colorado River is probably the single most significant natural resource of the entire western region, we find this puzzling. In addition, the population of nearly 14 million people currently receiving municipal and industrial water from the Colorado River must be considered in the rankings.

The documents evaluations must consider the natural resource value of the Colorado River, the population/density served with municipal, industrial and agricultural water

downstream, and other important potential geohydrology, environmental, and socio-economic impacts to the Colorado River. Consider the following factors which were not adequately evaluated in the technical guideline evaluations.

The following factors must be evaluated in the final EA:

(1) The proposed Davis and Lavender Canyon sites are physically located only 12-15 miles from the mainstem Colorado River, and the Canyonlands National Park obstructs adequate ground water data collection for all but about 1 mile.

(2) Although the site is remotely located from any major population centers, in 1983 the estimated U.S. population utilizing the Colorado River downstream was about 13,750,000. This figure will be increased to 15-20 million people in the 1990's as the Central Arizona Project comes on line.

(3) The agricultural lands receiving full or supplemental irrigation from the Colorado River are roughly estimated at over 4 million acres with an estimated annual cash receipt farmer crop value near $6 billion. In addition, 1.5 million acre-feet/year of Colorado River water is delivered and used for municipal, industrial and agricultural purposes in Mexico. Because these people and their water uses are not within the technical guideline boundaries of the site, these factors had no apparent bearing on the evaluation of acceptability. We believe this omission is not appropriate.

(4) Salinity is the most significant water quality problem in the Colorado River today. Under future depletion scenarios projected to 2010, salinity in the Colorado River is predicted to have an economic impact on water users below the proposed Davis/Lavender Canyon sites of $51.00/ton. The sodium chloride salts from the Paradox formation can reach dissolution concentrations of over 240,000 mg/L. For example, consider the possibility in ground water water flow of 1 cubic foot per second (ft^3/s) undersaturated of water contacting salt and discharging to the Colorado River. Such could add approximately 240,000 tons/yr of salt to the Colorado River with an economic impact of over $12,000,000 per year. This would equal the loading of the Department's biggest salinity control project. Ground water gains of 1 to 10 ft^3/s are conceivable and could occur in the critical river reaches potentially impacted, although proving the presence or absence of these gains is not within the technical accuracy of flow measurements given the volume of the Colorado River. The likelihood that salinity or radiological impacts to the Colorado River could be mitigated is very poor.

The surface storage of 140,000 to 10 million tons of salt has a potentially significant water quality impact. Removing most of the salt from the basin via railroad for final storage elsewhere would have prohibitive costs although this is certainly within present technological capabilities. Salt storage within the Colorado River Basin has uncertainty and risk. We estimate a 1 percent/year loss from 10 million tons of salt has a potential economic impact of $5.1 million/year on the downstream use of Colorado River water.

The paradox salt beds contain gaseous hydrocarbons. The potential impacts of an inadvertent explosion late in the operating life of the repository should be considered.

Even greater thermal impacts could occur than the EA addresses. In addition, an explosion could have major impacts on waste package containers in the shaft.

Estimated Groundwater Impacts—We believe modeling to assess groundwater travel times is not conservative given use of porous medium theory and transport models with no consideration of secondary permeability, e.g., fractures, joints, and dissolution features such as breccia pipes. In addition, the available hydraulic data are extremely variable, thus weakening conclusions reached in the report. Estimated groundwater travel times to the accessible environment vary throughout the EA and are inappropriately estimated at 10 kilometers (6.2 miles) from the site, as opposed to the outer boundary of the controlled area.

Radionuclide release scenarios assume a downward flow path and do not consider the potential for upward vertical hydraulic gradients (pre-waste emplacement) coupled with thermal buoyancy (post-water emplacement) and subsequent flow into the upper hydrostratigraphic unit. The latter scenario is important since water supply wells and springs in Canyonlands are located downgradient of the site in the upper hydrostratigraphic unit.

Acceptability of Environmental Impacts—Our perspective of an "acceptable" impact on park resources is fundamentally different from that of DOE. If standards appropriate to the pristine nature of a National Park are applied, it is evident that many impacts to park resources are not "acceptable." There is a tendency in the EA to consider impacts as temporary and site specific, and therefore relatively unimportant and mitigable. We disagree with this conclusion. In addition, the EA acknowledges that many of the environmental impacts to the park purposes and values are "significant" or "adverse," e.g., night sky illumination, noise, obstruction of unimpaired natural vistas. DOE then concludes that "most of the impacts cannot be mitigated to an insignificant level through application of reasonable measures, taking into account technical, social, economic and environmental factors." (EA, p. 6-42). However, DOE asserts that the impacts can be mitigated through the use of control measures and that the residual impacts will be "acceptable," thus apparently believing that significant impacts are nonetheless acceptable. We do not agree with the reasoning by which DOE arrived at such a conclusion and also disagree with the conclusion that these impacts are acceptable.

We believe the reasoning and analysis under the qualifying and disqualifying conditions related to these environmental impacts are flawed. First, there is little or no site-specific data regarding geohydrological or meteorological conditions, air quality or noise levels. Second, there is no apparent quality control or peer review for data pertaining to guidelines not requiring site characterization, i.e., socioeconomic, air quality, noise, etc. Third, the EA has no discussion or analysis of how the mitigation measures sketchily described might affect the magnitude, extent, duration or frequency of the impacts to the park which are otherwise predicted to occur. In addition, there is limited evidence supporting the probability of success for such measures. Therefore, there is no basis for the conclusion that the impacts will be acceptable. While we do not question that the impacts to the park can be mitigated to some degree, we believe the assertion in the EA that the resulting impacts will be acceptable must have some documented basis.

The EA indicates that site characterization activities will include further environmental studies aimed at collecting site-specific data which will allow impacts to be assessed more accurately. Presumably, the data collected will also permit DOE to evaluate the effectiveness of mitigation measures. DOE claims that these environmental studies "would precede the construction of the exploratory shaft." (EA page 4-62). Since some of the environmental studies will require one to three years of data collection, e.g., meteorological and air quality baseline information, a substantial amount of lead time would be needed. A more comprehensive assessment of the probable impacts to water resources during early-on characterization activities is also needed, so that the acceptability of expected impacts to Canyonlands NP can be assessed before those impacts are allowed to occur. It is difficult to assess the validity or reasonableness of that assertion since the EA does not include any graphic presentation of how and when the environmental studies occur vis-a-vis other site characterization activities. Based on Figure 4-24 (page 4-125) which depicts the cumulative site characterization work force requirements, however, it appears that all activities, shaft construction, geologic and environmental, will commence simultaneously. In addition, the DOE's recently released Preliminary Draft Project Decision Schedule implies that borehole drilling and shaft construction commence at approximately the same time. Therefore, apparently DOE contemplates collecting the needed environmental data at the same time it is engaging in those activities which are likely to have some of the most detrimental effects on park values and visitor enjoyment.

Canyonlands National Park—We are concerned about the potential impacts of locating a nuclear waste repository in such close proximity to Canyonlands National Park. We do not believe the conclusion that the Davis and Lavender Canyon sites are suitable for repository development under qualifying and disqualifying conditions related to conflicts with park values and environmental impacts can be supported. A thorough and careful evaluation taking into account all available and relevant information would conclude that the location of a nuclear waste repository at the Davis Canyon site will create unavoidable, irreconcilable conflicts with park values and purposes, and result in unacceptable environmental impacts on park resources.

The mandate of the National Park Service (NPS) is founded in the 1916 Organic Act, and was reemphasized in the General Authorities Act of 1970, as amended in 1978. The language prohibits all activities that would lead to the derogation of the values and purposes for which the units of the National Park System were established. These two pieces of legislation spell out a non-discrepancy mandate for the conservation and protection of park resources, and for their public use and enjoyment. We are required to protect and preserve the resources of each park; and, to ensure that each park's integrity is preserved for the enjoyment of present and future visitors. There is absolutely no provision in this mandate for balancing or for trade-offs to permit activities that in any way would compromise park resources or values. Therefore, we believe environmental degradation in an area, such as Canyonlands, which was established to protect natural resouces and unusual scenic beauty must be avoided.

Irreconcilable Conflict with Park Values—The DOE Guidelines require that a site be disqualified if certain conditions exist, specifically if the "presence of the restricted area or the repository support facilities would conflict irreconcilable with the previously designated resource-preservation use of a component of the National Park System" or if "the quality of the environment cannot be mitigated to an acceptable degree." We strongly believe that a credible evaluation of these disqualifying conditions requires a full description and consideration of the purposes and values of Canyonlands National Park as addressed in relevant NPS statutes and policies, park enabling legislation, and the park's General Management Plan and Statement for Management.

The EA's for the Davis and Lavender Canyon sites they neglect the most fundamental Act of Congress, which mandated the NPS in 1916. In Chapter 6, DOE incorrectly refers to the Organic Act of the National Park Service as 16 USC 1901-1912 (7 CFR Part 9), and subsequently states that the "...Act is not applicable because site does not lie within a National Park." The proper citation for the NPS Organic Act of 1916 is 16 USC 1, 36 CFR 1-199, and we strongly contend that the citation is applicable to DOE's proposed activities.

Further, the draft report entitled "Environmental and Socioeconomic Considerations of Locating a Nuclear Waste Repository Near Canyonlands National Park, Utah," December 1984, hereafter called the "Canyonlands Report," also seriously misrepresents the national significance of Canyonlands National Park and mischaracterizes the purpose and values of the park.

Specifically, the EA (and the Canyonlands Report) must include more comprehensive discussions of the following:

- NPS Enabling Legislation: The NPS Organic Act of 1916, 16 USC 1, and the August 18, 1970 and March 27, 1978 amendments to that Act, 16 USC 1a-1, serve as the basis for protection and management of all units within the National Park System. The 1916 Act mandates the National Park Service to:

  > "...conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

  The 1978 amendment, in particular, recognizes parks for "superb environmental quality through their inclusion jointly with each other in one National Park System preserved and managed for the benefit and inspiration of all people of the United States" while specifically providing that the:

  "...authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established..." 92 Stat. 166.

- Canyonlands National Park legislation: In establishing Canyonlands National Park, Congress stated that the area was being set aside as a national park to preserve "superlative scenic, scientific, and archeologic features for the inspiration, benefit and use of the public..." 78 Stat. 934. The legislative history of the park describes it as:

> "...a spectacular, fantastically beautiful place ...an area which ranks with Yellowstone and Grand Tetons. ... The total assemblage of features and their visual aspect is unique. Nowhere else is there a comparable opportunity to view a colorful, exciting, geologically significant wilderness from above, and then get down into its midst—and still not lose the atmosphere of remote wilderness... Scenery alone makes this physiographic unit of national significance and warrants the establishment of a national park within it. The geologic interpretation of that scenery enhances it, and can be done simply, meaningfully, and dramatically. Archaeological, historical and biological values buttress the significance." H. Rep. No. 1823, 88th Cong., 2d Session.

Much of the above language is also incorporated into the Senate Report which provided background information on why the park was established and referred to Canyonlands as "a vast area of scenic wonders and recreational opportunities unduplicated elsewhere in the American Continent or in the world." S. Rep. No. 381, 88th Cong., 1st Sess. Both the Senate and House reports specifically mentioned areas outside the proposed park boundary; notably, the Sixshooter Peaks were among the features referenced which Congress expected to be "landmarks for centuries to come," and, in fact, the Sixshooter Peaks area was originally considered for designation as part of the park.

- Canyonlands General Management (GMP) and Statement for Management: The proposed activity is in direct conflict with these documents which are based upon park enabling legislation. The General Management Plan is directed towards goals the goals of assuring that "the park serve both as a major scenic attraction and as a model for preservation of a unique natural environment."

In support of the GMP, the Statement for Management objectives include, (a) minimizing adverse impacts on the natural environment from human activities; (b) preserving the air clarity of the park to provide for public enjoyment of the scenery with no visibility impairment; (c) managing the Island in the Sky District as a series of viewing platforms emphasizing the concept of increasing naturalness and remoteness as the visitor descends in elevation; (d) preserving and protecting significant historical and archeological resources including the Salt Creek Archeological District which was added to the National Register of Historic Places in 1975; (e) fostering visitor appreciation and understanding of the evolution of the landscape; and (f) cooperating with other entities to insure that land and water uses within or near the park environs have minimal adverse effects on park resources. Similar associations of conflict can be made with other management objectives of the park.

The EA must be revised to recognize that Congress deemed to set aside national parks in general, and Canyonlands National Park in particular, for the preservation of unique qualities of national significance with a multitude of purposes and values. Unless comprehensive discussions of the legislative basis, and the purposes and values of Canyonlands National Park are included in the EA, any decision based on site suitability is misleading.

In addition, the primary resources for which this Department has jurisdiction must not be underrepresented in the EA. The resources and values which may be jeopardized by proposed actions are discussed below.

Primary Resources of Canyonlands National Park—Canyonlands National Park encompasses four primary resource groups composed of the numerous and diverse qualities identified for protection. These resources include: (a) natural ecosystem baseline resources; (b) archeological resources; (c) scenic resources; and (d) wildland recreation resources. While these categories share commonality, they are distinct enough to deserve specific attention when evaluating the impacts of the activities proposed by DOE.

The natural ecosystem of the park possesses scientific and social value as a baseline or control for monitoring human-induced change in non-park environments. In addition, parks provide natural laboratories for studies of ecological processes which can contribute to understanding human use of natural resources. These ecosystem resources include air, water, flora, fauna, geology, soils and other biotic and abiotic components of the natural environment. The coverage of these resources and related potential impacts is probably strongest in the EA among the four groups discussed here. Nonetheless, we are concerned about the adequacy of the data base, evaluation of impacts, and proposed mitigation measures. The threatened and endangered species and wildlife categories are particularly lacking. We believe more extensive threatened and endangered species surveys should be performed in the park. Conclusions that impacts on wildlife species such as desert bighorn sheep will be minimal and temporary are unsubstantiated.

The archaeological resources of Canyonlands, recognized in the enabling legislation and further acknowledged in the establishment of the Salt Creek Archaeological District in 1975, are of both scientific and recreational value. It is our responsibility to assure their protection and preservation at present and in the future for the purpose of study as well as providing visitors the opportunity to experience such resources. The Salt Creek Archaeological District is located within 1000 feet of the proposed repository site. The EA dismisses potential degradation of these resources as being indirect, proposing mitigation through worker education. Documentation of archaeological vandalism in southeastern Utah indicates that education is not effective at stopping digging when pots valued at $5,000 are the bounty. Vandalism is a very significant potential impact, and the final assessment must perform an analysis of worker attitudes or behavior patterns as they relate to avoiding vandalism.

The scenic resources, so celebrated in the legislative history and the Act establishing Canyonlands National Park, embrace air quality, geologic features, and expansive vistas integral the park visitor experience. Scenic resources, altered by drilling and construction activities on site and in Lockhart Basin, and possible railroad routing across the east side of the Canyonlands Basin are cursorily addressed under aesthetic resources. No attempt is made to link scenic alteration with specific data about visitors at the multitude of viewpoints in The Island in the Sky and Needles District of the park, or on Hart's and Hatch Point on the park perimeter. Esthetics extend beyond the visual characteristics. Aesthetics is the philosophy of beauty; beauty is the core of a national park. Although beauty cannot be easily quantified, it should not be dismissed, for Congress and this Nation have held it in high regard since the enactment of Yellowstone National Park over one hundred years ago.

The wildland recreation resources provide the visitor the opportunity to experience ecosystems unaltered and untamed by human activities, freedom from social constraints, solitude, and silence. The essence of this element is human perception, experience, and valuation of the wildland environment.

We are extremely concerned about the impacts on visitor perceptions of naturalness and wildlife-related values of the park. The influx of over 1000 workers has not been studied or related to use patterns in the park, potential conflicts among park user groups, or strategies for resolving user conflicts. Environmental changes in terms of noise, air quality, traffic along the entrance road, and the mere presence of industrial facilities on the edge of the park are not related to data about visitor behavior, expectations, satisfaction, or displacement. In a 1980 study of visibility impairment in Mesa Verde and Grand Canyon National Parks, it was found that "visitors felt that 'naturalness' was more important to their recreational experience than the specific attributes for which the parks are famous. "...these visitors felt that clean, clear air was a part of naturalness." In addition, the study revealed that "as visitors say they become more aware of haze, they also say their enjoyment with the view decreases, their overall park enjoyment decreases, and their satisfaction with visibility decreases." (Executive Summary, 1985, Ross, Haas and Loomis). These results indicate that air quality degradation negatively influences the park visitor experience.

In table 6-4, the EA dismisses noise impacts as acceptable because "long-term annoying levels of noise are not expected to be present at often visited places." People visit Canyonlands National Park to experience the wildland recreation values of solitude and silence. To evaluate the acceptability of noise on the basis of the number of people annoyed is to ignore the congressionally established wildland values of the park.

The EA states that "Canyonlands could lose some tourists who would have come...for a wilderness experience at the park...[the project's] presence may have an adverse effect on visitors who seek a wilderness experience adjacent to the proposed site." (EA, page 5-81). DOE's proposed solution to this impact is to "direct visitors to unaffected areas of the park" and the "scheduling of activities during the off-season." Id. It is not until the decommissioning and closure stage of the project (i.e.,

30 years after site characterization activities begin) that DOE envisions "...gradual elimination of noise, dust and night lighting; thus, adverse impacts on the wilderness experience will be eliminated." (EA, page 5-144, Summary Table 5-27). The clear implication of these statements is that the wilderness experience—which is an established park value—will not be possible in portions of Canyonlands National Park during site characterization activities, repository construction and operation.

Not only are these primary resources insufficiently regarded in the EA, but resource information and discussions of proposed activities are so scattered that it is not possible to relate the two and draw conclusions about individual or cumulative impacts in either the short- or long-term perspectives.

National Parks have been set aside in perpetuity for future generations. This temporal perspective separates Gibson Dome as unique among the areas being considered for repository siting. The EA tends to regard impacts as shortterm, failing to substantially address activities after the 3-year operation and decommissioning of the repository. The NPS believes that site monitoring and possible waste retrieval during the fifty years after repository closure (required by the Nuclear Waste Policy Act) could have significant effects on park natural and archaeological resources, the park visitor experience, and park image. While we recognize that the guidelines do not require evaluating environmental impacts after repository closure, we feel that such factors should be incorporated into the assessment of site suitability.

We are concerned about the possibility of unexpected underground contamination beyond the established controlled area during or after repository operation. Should contamination extend within the Park boundaries, it is unclear whether DOE would expect access for drilling purposes to determine the extent and location of spillage. Drilling in Canyonlands National Park is unacceptable under NPS statutes and the Wilderness Act. Therefore we believe the assessment of impacts under a worst-case scenario has not been evaluated considering the restrictions of the park upon the site.

When the impacts on the park, as described sequentially in the EA, are viewed as a whole, the conclusion is that Canyonlands National Park will experience at least 30 years of noise, dust and night lighting impacts which could adversely affect a substantial number of park visitors over time, and perhaps totally change the character of the area. Once the EA has been revised to comprehensively assess these impacts on the natural, scenic, archaelogical, and wildlife resources in the context of the congressionally enacted purposes and values of Canyonlands National Park, we believe that the conclusion indicating "irreconcilable conflicts with the park is not present for the Davis and Lavender sites" cannot be supported.

Drilling Within the Boundaries of Canyonlands National Park—The issue of whether drilling within Canyonlands National Park will be needed to assess geohydrologic conditions and flow patterns must be resolved before a final decision is made regarding site characterization. The proximity of Canyonlands to the Davis Canyon and Lavender Canyon sites limits the areal extent of geologic and hydrologic investigations needed to adequately characterize these sites and also places serious limitations on post-closure

monitoring activities. This is a particularly significant concern since the most likely paths of groundwater flow from the waste emplacement zone are directly under Canyonlands. We believe that geologic boreholes and hydrologic testing within the boundaries of Canyonlands would be needed during characterization to detect structural, stratigraphic, lithologic, and geohydrologic variations in the local geologic setting. Review of geologic and hydrologic investigations proposed for characterizing other proposed repository sites indicates the standard approach to geologic and hydrologic investigations, e.g., a more even distribution and spacing of boreholes surrounding the proposed sites is proposed.

The proposed monitoring program shown in the EA appears to have been influenced by the park boundary. It is obvious that the park boundary does not affect the hydrology of the site. We believe a sound, scientific monitoring program should be established to detect radionuclide excursions and to protect park resources. If a scientifically formulated monitoring program requires drilling in the park, this issue should be addressed separately and should not affect the design of the monitoring program. Further, because drilling within the park would not be allowed under any conditions, this site must be disqualified if drilling within park boundaries were found to be necessary.

The section on Site Characterization Activities is extremely difficult to follow, because the cumulative impacts are not cumulatively displayed or analyzed. A cumulative impacts section that shows: total acres disturbed, total acres occupied by structures or fenced, total water use, total AUMs not available to livestock and wildlife, total workforce, etc., should be provided in the final EA. We realize that much of this detail will be part of the characterization plan. However, without a cumulative analysis we cannot assess what the magnitude of the impacts would be if Site Characterization Activities were authorized by this Department.

The final EA should show evidence that compliance with the requirements of Section 106 of the Historic Preservation Act (36 CFR Parts 60 and 800) has taken place. Determination of National Register eligibility cannot wait until some later phase or final repository development. This information is needed for land withdrawal activities.

The socioeconomic analysis was based on outdated data and does not reflect the present situation in southeast Utah. The final EA should be revised to assess current information.

Secondary impacts—There is no mention of secondary impacts from increased recreation (e.g., camping and hiking) outside of Canyonlands National Park. Likewise, secondary impacts caused by the influx of 5,150 persons into this region would extend over a large area including the La Sal and Abajo Mountains. The impacts should be addressed.

Transportation

It is evident that the most direct routes for truck transport of radioactive waste for those powerplants located in Arizona, southern California, Texas and the Southeastern part of the United States would be to access I-10; I-20; or I-40, Flagstaff, Arizona;

Chambers, Arizona; Gallup, New Mexico; Thoreau, New Mexico; or Albuquerque, New Mexico and turn north and cross the Navajo Indian Reservation for approximately 150 miles through the Four-Corners area and to the proposed repository site. It can be reasonably assumed that these routes would be the safest statistically, based on the frequency of accidents per mile or time traveled. It is also reasonable to assume that these routes will be designated by the States as haul routes for the radioactive wastes since approximately 30 plants licensed to operate would find the I-40 route the most favorable. It is the most direct route and equally important, the route is less likely to be affected by winter weather and no high mountains would have to be crossed.

The routes described above must be evaluated in the final EA for anticipated impacts and secondary effects from the proposed action, especially those portions of the routes which cross the Navajo and Ute Mountain Indian Reservations. The highways across the Navajo Reservation were not designed or constructed to support the traffic volumes or with the safety features which may be necessary to protect the local inhabitants and the traveling public from potential hazards of transporting radioactive wastes.

Should either the Davis Canyon or Lavender Canyon sites be selected for development, a commitment must be made to either upgrade these routes or assure that they will not be used as transportation routes for the nuclear wastes.

The movement of radioactive materials into the storage area would go through two or three of the larger populated communities on the reservation. There is also heavy traffic through the eastern and northeastern portion of the reservation with a reasonable probability of vehicular accidents and possible spillage due to accidents. This could pose potential health hazards to the area residents. The EA should note that specific transportation accident measures will have to be developed for potential spills on the Navajo Reseravation. Emergency response modes on the reservation should be developed in conjunction with the affected tribes.

Specific Comments - Davis Canyon

Estimated Groundwater Impacts

We believe modeling used to assess groundwater travel times is not conservative given use of porous medium theory and transport models with no consideration of secondary permeability, e.g., fractures, joints, and dissolution features such as breccia pipes. The available hydraulic data are extremely variable in the EA. Thus the conclusions reached in the report may not be supportable.

Several illustrations (e.g., Figure 3-26, page 3-77) show the controlled area/accessible environment boundary to be much less than 10 kilometers and outside the park boundaries. Nevertheless the groundwater travel times are calculated to 10 kilometers. If the full 10 kilometers must be included in the controlled area in order to meet groundwater travel time requirements, the boundary would fall within the park, which is not under DOE control.

Estimated groundwater travel times to the accessible environment vary throughout the EA and are inappropriately estimated at 10 kilometers (6.2 miles) from the site, as opposed to the outer boundary of the controlled area.

Radionuclide release scenarios assume a downward flow path and do not consider the potential for upward vertical hydraulic gradients (pre-waste emplacement) coupled with thermal buoyancy (post-waste emplacement) and subsequent flow into the upper hydrostratigraphic unit. The latter scenario is important since water supply wells and springs in Canyonlands are located downgradient of the site in the upper hydrostratigraphic unit.

Relative Risk to Regional Water Resources

Chapter 7 and Appendix A of the EA include no discussion of the relative risk of the various repository sites to regional water resources, e.g., the relative risks associated with (a) a radionuclide release to the Colorado River from the proposed Gibson Dome sites and resultant impacts to downstream municipal, domestic, irrigation, electric power, and recreational uses; (b) a radionuclide release to the regionally-important Ogallala Aquifer from the proposed repository sites in Texas; and (c) radionuclide releases from the other proposed sites to appropriate regional water resources.

Ranking Criteria

We do not agree with the DOE analysis. We believe certain factors were inappropriately considered when analyzing the Gibson Dome (Davis and Lavender Canyon) sites in relation to the DOE siting guideline criteria. We recommend reconsideration of the Gibson Dome sites in relation to the siting guideline criteria, particularly in the following areas:

Geohydrology (Post-Closure)

Favorable Condition 1

The EA finds that the Gibson Dome sites have a pre-waste emplacement travel time of more than 10,000 years. We do not agree with this assumption as follows:

- A conservative approach would assume that a catastrophic event such as explosion (methane is found in the Paradox Formation), accident or failure of the engineered portions of the system may allow an early release of the salt from the Paradox to either the upper or lower hydrostratigraphic units. Using this assumption, travel times for the upper, middle and lower hydrostratigraphic units would be assessed and evaluated against the criteria independently.

- Travel times for the upper and lower hydrostratigraphic units could easily be within the 10,000 year travel time criteria if a fracture network is assumed. Assuming that secondary permeability is the predominant avenue of flow, travel times can be reduced by several orders of magnitude.

Under these assumptions this favorable criteria is not demonstrated to be present.

Favorable Condition 2

Only changes in climate affecting the hydrologic system at the Gibson Dome sites are considered. There are other processes that are present in the Quaternary that are continuing, and that will possibly affect the hydrology of the sites. Dissolution, breccia pipe formation and wholesale dissolution subsidence are present at sites in proximity to the Gibson Dome area. The subsurface fault R shown on Figure 3-19 (page 3-41) extends to within 1.5 miles of the border of the operations area for the Davis Canyon Site. This fault may be, or could start to be, the focus of dissolution near to the site. The fact that the EA never mentions the possibility of breccia pipes is a major concern to us. Breccia pipes have been demonstrated to occur in the Paradox and are possibly forming by similar processes in the subsurface. The R fault represents a condition that is conducive to dissolution and breccia pipe formation.

As stated above, processes that operated in the Quaternary are continuing to act in the present and could affect the hydrology of the Gibson Dome sites. Therefore, this favorable condition is not present.

Favorable Condition 4

Conditions (i) and (ii) cannot be assumed to be present if the effect of secondary permeability is considered. Further, conditions (ii) and (iii) are not present if the assumption of exclusive downward gradients is not used.

Overpressuring in the Paradox Formation in irregular zones is not uncommon. ONWI 290, section 9, shows several wells both north and south of the Gibson Dome sites that exhibit abnormally high hydraulic heads. Page 9-9 of the report interprets the high head values as indicating discontinuous lenses of fluid bearing permeable strata.

In ONWI 491 a high head value of 5575 was encountered in drill stem test for interval 14 of the GD-1 core hole. This value was significantly higher than the other values received for the Paradox Formation and ONWI 491 discounted the value as inconsistent and attributed it to salt squeeze in the interval. This high head value is consistent with the variable head values shown in ONWI 290, section 9. Therefore variable heads create a situation where the hydraulic gradient is either up or down. Exclusive downward gradients cannot be assumed and low heads are not always evident.

Even in the presence of a prevailing downward hydraulic gradient, thermal buoyancy may overcome a weak gradient and allow upward migration. The downward gradient is weak and thermal buoyancy would allow waters heated by the waste induced heat (250°C) to migrate upward.

None of the four conditions can be stated as existing, therefore, this favorable condition is not present at the Gibson Dome Sites.

Potentially Adverse Condition 1

Thermal buoyancy will affect the hydraulic gradient, as discussed above.

Potentially Adverse Condition 2

The assumption of exclusively downward migration of waters from the repository cannot be made as discussed above. An upward migration and connection with the upper hydrostratigraphic unit will place the flow path of radionuclides into waters with TDS values well below the 10,000 parts per million range. The park withdraws well water for park use from the upper hydrostratigraphic unit and springs in the park also issue from this unit.

Since upper hydrostratigraphic unit waters could be contaminated in a release, this potentially adverse condition is present.

We recommend the assumptions in the EA merit a change in the utility ranking for the Davis Canyon site from "9" to "6" for this criteria. This reflects the fact that four of the favorable conditions are not present and that two of the potentially adverse conditions are present.

Rock Characteristics

Favorable Condition 1

In the GD-1 corehole the uppermost halite of the Paradox Member is in evaporite cycle 4 where it is only 11 feet thick. The halite unit

in evaporite cycle 5 is about 70 feet thick. The halite units of both of these cycles thin rapidly to the south and it is anticipated that at the Davis Canyon and Lavender Canyon sites no halite will be present in evaporite cycle 4 and it will be very thin or possibly missing in cycle 5. Thus it is possible that in the area of the two sites the uppermost salt bed will be the depository horizon (salt 6). We are concerned that the EA's do not address the fact that halite barriers to upward release of nuclides in the two sites are minimal and that this characteristic was not used in making comparisons with the other salt sites.

Potentially Adverse Condition 2

The potash mineral carnallite ($KMgCl_3.6H_20$) contains 39 wt. percent H_20. Through the range of -12° to 167.5° C the mineral is stable but above that temperature range the mineral begins to loose water of crystallization according to the following reaction:

solid	solid aquaeous
$KMgCl_3.6H_20$	$KCl + MgCl_2 + 6H_20$

The solution resulting from this reaction is highly corrosive.

The depository horizon at Davis and Lavender Canyons is evaporite cycle 6 of the Paradox Member. The halite of this cycle contains a carnallite deposit of regional extent. This deposit was present in the GD-1 corehole and although the amount of carnallite can be expected to diminish in the direction of the potential sites it is still quite likely that some carnallite will be present. Because this deposit is in the upper half of salt 6, the depository openings will of necessity be located beneath the carnallite. The heat pulse from wastes emplaced below the carnallite deposit should be sufficient to result in melting of the mineral and generating small pockets of brine in the associated halite rock. In addition to brine formation the melting of carnallite will involve volume changes. These factors will markedly influence the stability of the salt placed in the depository openings and could also bring relatively large volumes of corrosive brine into contact with the waste package. These effects have not been given adequate consideration in the EA's.

Potentially Adverse Condition 3

Thermal uplift at the site will likely cause fracturing in the top 625 feet of the overburden above the site. This uplift will spread out in all directions from the site for a distance of 2-3 miles. The top 625 feet will include extensive portions of the Cedar Mesa and Elephant Canyon Formations. Both of these formations supply water to wells or springs within the park.

Since fracturing of the upper hydrostratigraphic unit was not considered by DOE this potentially adverse factor is present.

We believe that the stated differences with the DOE assumptions merit a change in the utility ranking for Davis Canyon site from "9" to "7" for

this criteria. This change reflects the fact that one favorable condition is not present and that two potentially adverse conditions are present.

Tectonics (Post-closure)

Potentially Adverse Condition 6

Salt flowage is a continuous process. There is evidence that salt flowage processes continue today. Cataract rapids on the Colorado River are formed by local uplift of rocks by salt so that they are rising faster than the river is cutting them down.

Steven M. Coleman, 1983, in "Influence of the Onion Creek Salt Diapir on Late Cenozoic History of Fischer Valley, SE Utah" (Geology, GSA, V. 1, P 240-243) recounts salt flowage processes in nearby salt diapirs. Similar salt flowage processes continue at Gibson Dome at a slower rate.

Evidence of the emergence of Gibson Dome can be inferred from the fact that Quaternary sediments are being deposited upstream of the point where the Indian Creek crosses the hump of the dome. Downstream of this point all the sediments have been swept clean. Coleman relates a similar process at the Onion Creek Diapir stating that the rising diapir impedes the flow of the streams to cause deposition. The same process can be inferred to be active at Gibson Dome. Note the area of Quarternary alluvium on the Geologic Map of Canyonlands National Park (Huntoon, et al, 1982, Geologic Map of Canyonlands National Park, Utah).

There is evidence that there is salt movement within the Gibson Dome, therefore the potentially adverse condition is present.

We believe that our opinion of the assumptions made by DOE merits reconsideration of the utility rating for this criteria from "8" to "7." This change reflects the fact that one favorable condition is not present and that one potentially adverse condition is present.

Favorable Condition 2

Since upward migration is possible, radionuclides may reach the upper hydrostratigraphic unit where water quality is well below the 10,000 TDS level (see table 3-10).

Since radionuclides may escape to the upper hydrostratigraphic unit and be released through human efforts, this favorable condition is not present.

We urge that these differences with the DOE assumptions merits a change in the utility ranking value from "9" to "7" for this criteria. This change reflects the fact that two favorable conditions are not present and one adverse condition is present.

Data vs. Rankings

Chapter 6 relates the data for each individual site to the DOE siting guidelines. There seems to be no correlation of the evidence presented in Chapter 6 relative to the siting guidelines and the ranking values given in Chapter 7.

The siting guidelines establish 20 criteria covering both pre- and post-closure conditions. Each criteria is supported by qualifying conditions, disqualifying conditions, favorable conditions and potentially adverse conditions. None of the sites were disqualified. All were deemed qualified. The discriminating factor between sites is how they fared in the favorable and potentially adverse conditions.

Given the effort to analyze the sites vis-a-vis the siting guidelines, there should be a strong correlation between the success of a site to meet favorable or potentially adverse criteria and the sites favorability values expressed in Chapter 7 and Appendix B. This correlation is lacking.

To analyze the correlation of the siting guideline criteria to the ranking values presented in Chapter 7 and Appendix B, a table was prepared listing the determination given for each site relative to each criteria favorable and potentially adverse conditions. A deleterious condition is described as a finding that a favorable condition is not present, or that a potentially adverse condition is present.

The number of deleterious conditions was summed for each criteria for each site, and compared to the utility ranking given each site for each criteria. The result showed no apparent correlation in most cases. There is no methodology or supporting evidence to support this lack of correlation. The discrepancy between the data in Chapter 6 and the conclusions reached in Chapter 7 again raises concern regarding the EA.

The tables were prepared from data given in Chapter 6 for all nine EA's and with the values given in Table B-2 (page B-9), and Table B-3 (page B-3).

The following remarks refer to the tables:

Geohydrology

Deaf Smith, Davis Canyon and Richton Dome all received a "9" utility ranking value, yet Richton Dome failed to meet two favorable conditions and had one potentially adverse condition present for a total of three deleterious conditions. Davis Canyon had two deleterious conditions and Deaf Smith only one. Hanford exhibited only two deleterious conditions yet received a utility ranking of "6." Yucca Mountain had three deleterious conditions and received an "8" for utility ranking. There is no correlation. The data and rationale to support the difference should be stated in the EA.

Off-Site Installation and Operations

Davis Canyon and Yucca Mountain both had only one deleterious condition. However, Davis Canyon received a "9" utility value, while Yucca

Mountain was rated a "3." The EA should explain the basis of this difference in the rating.

Conservatism

The Nuclear Waste Policy Act of 1972 requires that the DOE be conservative in the face of uncertainty. This does not seem to be the case in the methodology and conclusions detailed in the EA. For example:

- Page 6-81 in the first full paragraph implies that secondary permeability is likely to lower estimated travel times by at least an order of magnitude. Yet the calculations and modeling in the EA ignore the possibility of fracture networks enhancing groundwater flow significantly above estimates made by porous media theory. Travel times can differ by several orders of magnitude. The higher permeability values for field tests compared to the laboratory tests shown in figure 3-38 (page 3-139) indicate some influence of secondary permeability.

  The absence of any substantial fracture networks in GD-1 is not conclusive that extensive effective fracture networks do not exist. Conservatism would decrease travel times to allow for expected secondary permeability.

- Page 6-82 paragraph 2 states that the upper hydrostratigraphic unit was not considered as a possible excursion path since there is a prevailing downward hydraulic gradient. When analyzing the hydraulic head information in ONWI 491, the DOE contractors eliminated a reported head value of 5575 feet for increment 14 of GD-1. In a prior ONWI report, ONWI 290, DOE displays head data for several wells both north and south of the site that had hydraulic heads in this range. ONWI 290 interpreted these heads as reflecting irregular lenses of fluid bearing permeable strata exhibiting overpressuring.

  Rather than being inconsistent, the GD-1 test result of 5575 feet of head fits the regional pattern. The positive gradient it expresses does not fit the downward gradient model, but is a very real possibility. Conservatism would take into account the possibility of encountering an overpressurized zone imparting an upward gradient.

- Page 6-211 paragraph 3 speaks of the "unlikely" event of a failure of a shaft seal within 70 years of emplacement. This statement is misleading.

  In fact, the shaft sealing will push the limit of the state-of-the-art technology in pressure grouting techniques for a shaft environment by expecting 100% effective containment for 70 years. The seals will be subjected to vibration, differential thermal expansion, heat, methane, hydrogen sulfide, salt, pressure, water, tension, compression, possible accident, explosion or failure of another integral component. A shaft seal failure is more likely that unlikely.

  Maintenance, monitoring and contingency planning are all necessary to make the system viable in the face of component failure. The EA should address the effects of seal failure, the possible mechanisms of shaft failure, mitigation if failure occurs, and prediction and identification of

seal failure. These issues are particularly important when considered with possible upper hydrostratigraphic unit excursion scenarios.

Weights

The ranking system assumed that each factor within a group of criteria was treated equally. Whether this reflects reality is debatable, but for simplicity's sake, this assumption is convenient.

The act requires that the post-closure criteria be weighted more than the pre-closure criteria and that the radiological safety criteria, within the pre-closure criteria should be weighted more than the environmental/socioeconomic/transportation criteria, which in turn should be weighted more than ease and cost of siting criteria.

Selecting meaningful weights is an arbitrary job at best. Although it is intuitive that there should be some extra emphasis placed on meeting the post-closure criteria, the magnitude of that emphasis is not readily apparent. DOE chose to nominally meet these requirements by assigning a weighting factor of 51% to the post-closure criteria and 49% to the pre-closure criteria. Weights were assigned to the pre-closure criteria so that radiological safety was assigned 35%, environment/socioeconomic/transportation was assigned 33% and ease and cost of siting was assigned 32%.

Using these formulas the individual post- and pre-closure criteria averaged the following weights:

Post-closure	5.67
Pre-closure	4.45

Each individual post-closure criteria carries 27% more weight than the average pre-closure criteria. We believe that the 51%/49% split between post- and pre-closure criteria not only meets the requirements of the Act, but that the 27% relative emphasis of the individual post-closure criteria over the average pre-closure criteria is appropriate.

We strongly recommend that the 51%/49% split between post- and pre-closure be retained.

The 35%/33%/32% split within the pre-closure criteria does not meet the same success in meeting the letter of the requirement that one group of criteria be weighted more than the others. The average individual weight for each criteria within the three groups of pre-closure criteria using the 35%/33%/32% split is:

Radiological Safety	4.29
Enviro/Socioecon/Trans	5.39
Ease and Cost of Siting	3.92

The weight given each environment/socioeconomic/transportation criteria can be interpreted to be higher than radiological safety leaving DOE open to criticism that it does not meet the letter of the Act's mandate to have each preceeding criteria be given more weight than the subsequent criteria. By changing the pre-closure weights to 44%/32%/24% the resulting weights per criteria are:

Radiological safety	5.4
Enviro/Socioecon/Trans	5.2
Ease and Cost of Siting	2.9

We believe that the 44%/32%/24% split within the pre-closure criteria allows the DOE to meet the requirements of the Act in all possible interpretations, and represents a more desireable distribution of weights, showing an appropriately stronger emphasis of environmental and socioeconomic concerns over that of cost considerations.

Conflict of "Controlled Area" with Dedicated Lands of Canyonlands

The EA mentions that the specified controlled area is preliminary and may change based on characterization information; however, the EA does not specifically address whether the site would be disqualified if the controlled area overlaps with the dedicated lands of Canyonlands.

The EA projects thermal uplift of the ground surface of up to one meter with decreasing uplift out to a distance of two to three miles from the site. As a result, this uplift will directly affect and may occur within the dedicated lands of Canyonlands National Park. It is not apparent in the EA that this effect was considered in terms of defining the "controlled area" nor were the potential impacts of such an uplift on the water resources of Canyonlands National Park addressed in the EA.

Inconsistency

The EA is laden with inconsistent conclusions. Yet decisions regarding suitability of the site are theoretically based on this data. The inconsistencies throughout the document raise concerns regarding the data and conclusions in the EA.

- Page 3-131 states that the hydraulic conductivity (permeability) in the field tests for the upper Paradox and lower Honaker Trail were within or below the range of laboratory tests results. Figure 3-38 on page 3-139 shows just the opposite. In all cases the short-term drill stem test was orders of magnitude greater than the lab tests. This discrepancy should be resolved.

- Page 3-114 paragraph 4 states that the precipitation is distributed fairly evenly throughout the years. Yet page 3-117 of the EA discusses flash flooding from thunderstorms in August and September.

- Much time and effort went into devising the system of favorable and adverse conditions outlined in the site selection criteria, and chapter 6 in each EA addresses the specific application of these criteria to each site. Unfortunately there is little correlation between the pairwise ranking, relative ranking and utility ranking values assigned to each site for each criteria and the performance criteria outlined in Chapter 6.

Limitations of Ranking Systems

Pairwise and relative ranking do not express the magnitude of difference between the individual sites within each criteria. Using such scores and

manipulating them with mathematics is inappropriate since a minor difference is weighted the same as a major one. Therefore, we believe conclusions drawn from such a process are ambiguous.

The utility ranking system, however, allows an expression of the relative magnitude of the differences between the five sites. Although such a system artificially constrains the expression of magnitude to discrete increments (1-10), a continuous scale of factors that are objectively and unambiguously measurable is the ideal. Given the immensity and complexity of the problem presented with analyzing nine sites in the face of uncertainty, the utility ranking system seems most appropriate.

We recommend the use of the utility ranking system over that of either the pairwise or relative rank ranking systems described in Chapter 7 and Appendix B of the EA.

Executive Summary

Page 6, Section 2.2.3 Selection of a preferred site in the Paradox Basin: Since EPA's standards for the management and disposal of spent nuclear fuel (40 CFR 191) have not been finalized, the EA cannot categorically state that the sites are located on multiple use lands. In addition, it is current Departmental policy that land for hazardous waste disposal can only be acquired through fee transfer or permanent congressional withdrawal. Therefore before DOE takes occupancy of any Federal lands administered by this Department, Congress must enact a transfer giving DOE irrevocable responsibility for the property. The geologic repository operations area lies within 1,000 feet of lands dedicated for National Park purposes. A portion of this site as now defined could be located within the National Park and therefore be disqualified. DOE acknowledges this in the third paragraph of section 4.1 and 4.3.3.

Page 8, Figure 2, Davis and Lavender Canyon Sites: The western boundary of the park is incorrectly drawn and labeled. Refer to detailed maps provided earlier.

Page 9: Language should be added to the first full paragraph as follows: "In addition, Canyonlands National Park was established to preserve its superlative scenic, scientific, and archeological features for inspiration, benefit, and use of the public (78 Stat. 934). The legislative history for the park notes its national significance and emphasizes wilderness character and solitude as important park values (Sen. Rept. No. 381, 88th Congress, 1st Sess.; House Rept. No. 1823, 88th Congress, 2nd Sess.). The Congress has ascribed high public value and integrity to units of the National Park System (16 USC 1a-1)." We believe this paragraph is essential to add because it establishes the significance of the park as an important issue for these sites and provides a basis for tracking this significance through the other chapters. In addition, without this additional language, the reader could be left with the false impression that the physical environment of the site is "unimproved rangeland."

In the second paragraph it should be clarified that lands in Canyonlands National Park which are immediately adjacent to the site have passed the wilderness study phase and have been recommended to Congress for wilderness designation.

The last sentence on this page states that the groundwater flow for the upper and lower hydrostratigraphic units is to the west of northwest. The EA, however, indicates a west-southwest flow direction for groundwater in the lower hydrostratigraphic unit. This inconsistency should be resolved.

Page 14, Regional and Local Effects of Repository Development, second paragraph: The 5,360 acres defined as the controlled zone is an area that extends 825 feet outward from the edge of the geologic operations area. The data used to develop this distance of 825 feet should be cited.

Page 18: The first paragraph notes that the groundwater travel pathway is expected to be downward, away from the surface, because of the downward hydrologic gradient of the site. The EA should address the potential for naturally occurring upward hydraulic gradients due to overpressurized zones in the middle hydrostratigraphic unit and also the possibility of groundwater moving vertically upward due to thermal buoyancy created by the temperature of the emplaced wastes. (See a more complete explanation of this comment in the discussion of chapter 6 below.)

Chapter 1: Process for Selecting Sites for Geologic Repositories

Page 1-7, Section 1.2.2 Salt Sites

The last paragraph states that the Salina Basin salt deposit was deferred from further consideration after the location phase. The Salina Basin is a Silurian salt bed in a relatively stable area with adequate thickness and cover. There is existing transportation infrastructure at the Salina Basin and it is located close to several nuclear waste producing facilities.

The EA should indicate the reasons consideration was deferred for the Salina Basin. It is unclear whether DOE can adequately assess the feasibility of salt sites without investigating this important salt basin. The EA should address how elimination of this basin from consideration could subvert the DOE goal of investigating a diversity of geohydrologic settings.

Page 1-9, Section 1.2.2.2 Bedded Salt

The application of the screening factors to Gibson Dome showed a location of 57 square miles near the center of the area that contained appropriately deep and thick salt deposits and was sufficiently far from faults or exploration boreholes that would make a site suitable. The fourth paragraph goes on to note that this area "appeared sufficiently distant from dedicated lands." The EA should indicate the proximity of this area to Canyonlands National Park, particularly since the delineated Davis Canyon site is only 3,100 feet from the boundary of Canyonlands.

Page 1-15, Section 1.2.5 Final Steps in the Site-Selection Process

In the first paragraph the EA should describe how DOE would substitute sites for those eliminated by characterization.

Chapter 2: Site Selection Process - Parodox Basin

Page 2-12, Table 2-3

This table should indicate that for the Gibson Dome location, the 100-year floodplain is present.

Page 2-14, Section 2.4 Comparative Evaluation

In the fourth paragraph of this section on page 2-17, in the comparison of the Davis Canyon and Lavender Canyon sites, the EA states that "the closest controlled area boundary for each site is less than 3.2 kilometers (two miles) from Canyonlands National Park." It would be more appropriate to specifically state the distance from the controlled area boundary of each site to the boundary of the park, e.g., for the Davis Canyon site, the controlled area is only 1,057 feet from the park boundary.

Page 2-15, Table 2-4

The rationale for not disqualifying the Davis Canyon and Lavender Canyon sites in this table includes statements that migration rates of possible dissolution features and expected tectonic activity can be accommodated by repository design measures. This statement needs to be further explained and fully documented, e.g., what design measures, what is their projected effectiveness, etc.

With regard to the Rock Characteristics guideline (960.5-2-9(d)), Table 2-4 indicates that potential hazards to personnel during repository construction, operation, and closure consist of gas pockets, excavation instability, brine pockets, water inflow, and dust,. It further states that these potential hazards have either not been found to date at the sites or can be mitigated by proven mine safety and engineering practices. Again, the EA must include more information on proposed mitigation measures, their estimated effectiveness, etc. Also, has DOE considered the occurrence of such hazards at other nearby mining operations in the Paradox Formation?

Since EPAs standards for the management and disposal of spent nuclear fuel have not yet been finalized, DOE cannot categorically state that the sites or related areas are not located within specified disqualifying areas. We believe the site in Davis lies within 3,100 feet of such a disqualifying area since according to table 2-6, the Davis Canyon site is within 0.2 km of Canyonlands National Park, not 1.6 km. The Lavender Canyon site is within 2.5 km, not 4 km.

Page 2-23, Section 2.4.2.1.2 Site Ownership and Control (960.5-2-2)

The EA should discuss the impacts from the blocking of public access to that portion of Davis Canyon lying within Canyonlands National Park. NRC regulation 60.121 states that lands within the controlled area shall be held free and clear of all encumbrances, if significant, such as "... easements for rights-of-way." From the wording in this regulation, NRC apparently considers easements for rights-of-way as "significant." The site, as presently defined, blocks all vehicular access to the Davis Canyon portion of Canyonlands National Park. We therefore believe a potential disqualifying condition may exist.

Page 2-25, Section 2.4.2.2.1 Environmental Quality (960.5-2-5)

In the third paragraph infers that salt deposition at this site would not be detrimental to any soils, plants, or animals in the park. To our knowledge, no testing has been performed on soils, plants, or animals native to and present in this area to substantiate this conclusion. Incremental increases in the existing soil salt content may well exceed the tolerance level of plant and animal species in the area.

Page 2-29, Table 2-7

This table should be revised to reflect that a potential disqualifying condition exists at Davis Canyon due to the possibility that a portion of the site may fall within the National Park.

Chapter 3: The Site

Page 3.5, Figure 3-2

This figure identifies the geologic repository operations area (GROA), the surface facilities, and the proposed controlled area boundary. The figure should also identify the "accessible environment," "restricted area," and the "disturbed zone."

Page 3-28, Section 3.2.5.1 Faulting

The discussion of dissolution in Lockhart Basin (p.3-36), should include discussion of the presence and role of breccia pipes. Also on page 3-36, the first paragraph states that field studies are "in progress." The text must describe the studies which are currently underway.

In the Paradox Basin there are essentially three types of faults.

1) Faults related to regional tectonics with surface expression, such as Shay Graben, Bridger Jack Graben, Sweet Alice Graben.

2) Faults related to regional tectonics with no surface expression, such as the faults shown in Figure 3-19, Page 3-41 of the EA.

3) Faults associated with salt flowage and dissolution, such as the faulting in the Grabens area and along Spanish Valley.

The EA should recognize the different origins and implications on repository performance of the three types of faults. The R fault in Figure 3-19 is less that 1.5 miles from the repository operations area. DOE should investigate the importance of the three types of faults and assess their importance. Given its proximity to the Davis Canyon site the R fault (Figure 3-19) should be examined in particular. DOE should evaluate the effects from these faults in developing dissolution features, in relation to seismicity and as conduits for vertical and horizontal hydrologic connection.

Page 3-40, Section 3.2.5.1

In paragraph 2 the text refers to "... a series of northwest-trending subsurface faults." shown in figure 3-19. The text ignores the southwest-trending fault "R" perpendicular to the general trend which terminates less than 2 kilometers (km) (1.25 mi) from the GROA. This should be evaluated.

Page 3-41, Figure 3-19 Reflection Time Contours Top of Mississippian

This figure shows a NE trending subsurface fault, labeled R, which comes within 1.5 miles of the boundary of the operations area. The fault is reflected in the top of the Mississippian section. Such a fault could be the conduit to bring Mississippian waters into contact with the lower Paradox Formation and allow dissolution to occur.

Page 3-70, Section 3.2.7.2 Hydrochemistry

The sixth paragraph of this section (page 3-71) indicates that concentrated and overpressurized brines have been encountered in the Paradox Basin. However, the EA states that "all of the reported occurrences are away from Davis Canyon and from stratigraphically deeper zones." The EA should indicate the paucity of site-specific data in Davis Canyon and should clarify what "from staratigraphically deeper zones" means.

Page 3-72, Section 2.3.8 Mineral Resources

At the end of this subsection, add: "One-hundred eleven mining claims were filed in June 1984 by the San Juan County Commission. The chairman of that commission has been quoted as stating there are valuable, locatable minerals located there."

Page 3-111, Section 3.2.9 Soils

No mention is made of the cryptogamic soil crusts characteristic of the soils of this region. These crusts play a critical role in stabilizing soils against erosion and in nutrient cycling. Disturbance of these crusts increases soil susceptibility to erosion and decreases nutrients in the soil complex.

Page 3-114, Section 3.3.1.1 Hydrologic Setting

This section states that the total precipitation is distributed fairly evenly throughout the year. Actually, rather than gentle, even precipitation, flash flooding after cloudbursts is not uncommon in this region. Page 3-117 (3.3.1.4 Flooding) states that there are extreme floods caused by cloudbursts in the months of August and September. This is further reinforced on page 3-148 (3.4.1.1 Land Ownership) where it is stated that during the last half of 1983 several floods washed out the register boxes in Davis Canyon preventing collection of visitor use data for the period July through December.

Page 3-117, Section 3.3.1.2 Streamflow Characteristics

The EA identifies four streamflow monitoring stations maintained by the U.S. Geological Survey in the Indian Creek Basin. Table 3-4 indicates that the period of record for these stations ranges from 1947 to 1971, with three of the

stations terminating data collection in 1957. The EA should indicate that these are not "active" stations. The text states the the "majority of flows occur ... from April to June." Since the mean monthly streamflow for March is identical to that of April (table 3-5, page 3-188), the "majority of flows" should either include March or not include April. Beyond that, the identical mean monthly flow for 2 successive months makes one suspicious that one of the values may be in error.

Page 3-117, Section 3.3.1.4

The text states that the peak discharge at Cottonwood Wash on August 16, 1968, was 11,935 cubic meters per second (421,000 cubic feet per second (cfs)). The actual value from Butler and Marsell (1972) was 42,100 cfs, or 1,194 cubic meters per second.

Page 3-121, Section 3.3.1.5 Water Availability and Demand

This section provides no specific information regarding surface water use in the immediate vicinity of the site, e.g., irrigation use.

Page 3-121, Section 3.3.2 Ground Water

During January of 1985, several seeps were discovered along the eddy line below Rapid Two in Cataract Canyon. It is likely that the seeps are under water during most of the year, only to be exposed at the lowest water levels of the winter. These seeps had a strong sulfur smell and what appeared to be whitish vegetative matter.

In a discussion at the public information meeting in January 1985, at Moab, Utah, a DOE geologist speculated that these could be coming from beneath the Paradox Formation. This speculation was based on the sulfur smell which is often associated with the Leadville Limestone underlying the Paradox Formation. If these seeps are in fact from the Leadville Limestone, this indicates seepage through the Paradox Formation. It should be noted that oil and gas exploration is common in the Leadville Limestone. The EA does not mention these seeps or their significance as indicators of seepage through the Paradox Formation. This should be addressed in the EA and in further studies of the Gibson Dome sites.

Page 3-125, Figure 3-34

The 100-year and PMF floodplain maps should be continued up Davis Canyon to the southwest corner of the GROA.

Pages 3-129-144, Tables

The tables presented in the groundwater section of Chapter 3 demonstrate numerous inconsistencies in the existing hydraulic data. For example, Table 3-11 indicates a mean permeability of 2.5 millidarcies for the Middle Hydrostratigraphic Unit, whereas Table 3-13 shows values of 0.0035 to 0.0001 millidarcies for the Paradox and Pinkerton Trail Formations, respectively. These values should be almost identical; instead they differ by three orders of magnitude.

We believe the numeric values for permeability in Table 3-13 are in darcies and not millidarcies (md). Also, Table 3-12 contains several values for hydraulic conductivity; the value of intrinsic permeability given for Hydrogeologic Test Interval #6 of 0.007 md does not correspond to values in Table 3-14.

Page 3-131, Hydrology and Modeling

Words have been omitted in the first paragraph, second line, the EA indicates that except where it is fractured, the Pinkerton Trail Formation, immediately below the Paradox Formation, functions as an aquitard. However, at Elk Ridge No. 1, circulation was lost in the Pinkerton Trail Formation indicating extensive fracturing, and others have classified the Pinkerton Trail Formation as an aquifer. The EA should carefully address the implications of an aquifer immediately below the host rock and further studies should be made to resolve the hydraulic characteristics of this unit.

Page 3-136, Table 3-12

It is unclear why footnote 5 is attached to centimeters per second (cm/sec) in the Hydraulic Conductivity column heading. Footnote 5 attached to static reservoir pressure from a drill-stem test (DST) in the Paradox Formation states that the value is inconsistent with the results of other DST's and is questionable. It certainly is inconsistent, but that in itself does not make the value questionable. It may simply be that there is very high hydrostatic pressure in this horizon compared to other horizons in the Paradox Formation. This issue should be resolved.

Page 3-136, Table 3-13

The data in table 3-13 are poorly and inadequately explained in the text. It is unreasonable to determine mean values of porosity and permeability for units that were sampled only one to three times. We question what level of confidence can be placed in these laboratory measurements.

Page 3-137, Figure 3-37

The EA should include the geologic source and rate of flow of springs and wells shown on Figure 3-37, i.e., rather than referring the reader to Table 3-15 which further references Thackston (1984), a letter report to ONWI.

Page 3-141, Figure 3-40

Given the specific potentiometric surface elevations provided in Figure 3-40, it is unclear how the potentiometric surface was determined, e.g., south of the Davis Canyon site there are nine contour lines yet there is only one observation point in this area. Also, no discharge areas are defined on Figure 3-40 for the Lower Hydrostratigraphic Unit, as identified in Figure 3-39 for the Upper Hydrostratigraphic Unit. If any discharge from the lower unit is believed to occur in the vicinity of the site it should be indicated on the figure.

Page 3-142, Section 3.3.2.1 Hydrology and Modeling

In the third paragraph on this page, the EA makes the statement that the conceptual groundwater flow system model is realistic. The basis for this

conclusion must be documented in the EA. The indicated need for collection of corroborating hydrologic data is well taken.

Page 3-143, Hydrology and Modeling

No information is given as to how a vertical hydraulic gradient of 0.085 was calculated in the Darcian flow calculation given at the top of this page. Based on information presented in table 3-12 for the Paradox Formation, the vertical hydraulic gradient appears to be about one order of magnitude greater than that indicated, i.e., using the potentiometric level of 3,184 ft msl at 2,600 ft depth and 1,461 ft msl at 5,000 ft depth.

Also on page 3-143, the EA provides preliminary estimates of groundwater flow rates in the strata above and below the repository rock using the concept of average linear velocity under Darcian flow conditions. Is this a reasonable approach given the fracturing apparent in these strata (see pages 3-131 and 3-132)? Similarly, we question whether DOE complied with guideline 960.3-1-4-2 which only allows the use of assumptions that would tend to underestimate the ability of a site to meet the qualifying conditions, e.g., a conservative analysis. The intent of this guideline was to require realistically conservative assumptions, e.g., the presence of fractures should be assumed so that conservative decisions can be made in the face of uncertainties (49 FR 47728). The statement is made on page 3-143 that many of the assumptions made in the analysis are conservative. Yet, it is clear that much more conservatism is called for.

Page 3-144, Table 3-14

Based on the data problems cited above for the tables and page 3-143, the validity of subsequent analyses is highly questionable. Almost any output can be derived from such a wide range of input values. As such, the linear velocity values in Table 3-14 are best titled "Hypothetical", as indicated in the title of the table and their tentative nature should be emphasized in the text.

Page 3-147, Section 3.4.1.3.2 Recreation

In the first paragraph under Recreation, delete the words "Needles District of." This will make it consistent with the Lavender environmental assessment, and recognizes that all areas of the park are important.

After the first paragraph under Recreation, add the following paragraph to establish the significance of the park as an important issue for these sites and to provide a basis for tracking this significance throughout the EA.

"Canyonlands National Park was established by Congress to preserve its superlative scenic, scientific, and archeological features for inspiration, benefit, and use of the public (78 Stat. 934). The legislative history for the park notes its national significance and emphasizes wilderness character and solitude as important park values (Sen. Rept. No. 381, 88th Congress, 1st Sess.; House Rept. No. 1823, 88th Congress, 2nd Sess.). The Congress has ascribed high public value and integrity to units of the National Park System (16 USC 1a-1)."

In the third paragraph under Recreation add backpacking as a recreational use, as distinguished from hiking.

Page 3-148, Section 3.4.1.3 Land-Use Patterns

Somewhere in this section, the EA should include a discussion of the role of Canyonlands as an ecological baseline. This is a fundamental park resource recognized in the NPS mandate, and one that would be impacted by site characterization and repository construction and operation.

Page 3-151, Figure 3-42

The proposed wilderness within Canyonlands National Park should be included on this map. The present map infers that wilderness values do not exist inside the park boundaries.

Page 3-153, Section 3.4.1.3.3 Wilderness Study Areas

In the last paragraph of this section, after the first sentence add: "This proposal includes the upper portion of Davis Canyon within the park."

Page 3-154, Terrestrial Ecosystems

This section should include an estimate of the acres of each vegetation type in the study area.

Page 3-158, Section 3.4.2.1.2 Fauna

In the fourth paragraph add: "peregrine falcons" after "prairie falcons," to make the text consistent with Figure 3-44.

Ring-tail cats exist in the Davis Canyon region. Mountain lions occur in the vicinity of the Davis and Lavender Canyon sites, most often in pinyon-juniper woodlands.

There is evidence indicating that peregrine falcons use the canyons around the Davis Canyon site. During the summer of 1983, Dr. Clayton White identified several falcon kills in Davis Canyon which he thought with confidence were caused by peregrines. A new peregrine eyrie has been found in a canyon seven air miles southeast of the Davis Canyon site, and four miles from the Lavender Canyon site. In addition to the one already noted in the EA, a second eyrie exists eight air miles to the west of Davis Canyon in Canyonlands National Park. There is potential for use of the Davis Canyon site by peregrines during some parts of the year, therefore making it peregrine falcon habitat.

The Salt Creek drainage is winter range for deer moving down from the high country around the Abajo Mountains south of Canyonlands National Park. Herds of up to 17 deer have been observed, with as many as 50 counted by visitors in upper Salt Creek. It is believed that the actual winter population is higher.

In paragraph four, the commercially or recreationally valuable species should be described. This general statement tends to dismiss the importance of these

species. Throughout the year, the Colorado River serves as major habitat for a diversity of water birds and passerines, including rufous-sided towhees, Virginia rails, great blue herons, black-crowned night herons, the white-faced ibis, white pelicans, Canada geese, common goldeneyes, teals, grebes, mergansers, and many more waterfowl. The importance of this water source and habitat should not be overlooked, as it plays a critical role in a region where large bodies of water are very limited.

Page 3-158, Section 3.4.2.2 Aquatic Ecosystems

Vegetation along the Colorado River is not sparse; the vegetation serves as habitat for birds and insects. Beaver are common along the banks of the river as well.

Page 3-159, Section 3.4.2.3 Threatened and Endangered Species

Documentation of Colorado River Squawfish larvae and young-of-the-year fish at the mouth of Indian Creek indicates this area is very important habitat for this endangered species. The final sentence of the fourth paragraph should be changed to say that the last mile of the Indian Creek drainage near its confluence with the Colorado River does meet minimum requirements as endangered species habitat. Colorado River squawfish spawning areas have been identified just below Horsethief Canyon at river mile 25, and in Cataract Canyon.

Page 3-161 - 3-162, Figure 3-44

Beaver occur along the banks of the Colorado River. There is a heron rookery near the Colorado River bridge in Moab. Two peregrine eyries should be added to this map: one is approximately seven miles southeast of the Davis Canyon site, and the other is approximately eight miles west of Davis Canyon. This second site is located in Canyonlands National Park. The discovery of these new eyries in recent surveys raises concern about the validity and completeness of the initial inventory on which assessments pertaining to threatened and endangered species have been based.

Pages 3-163 - 3-164, Figure 3-45

Upper Salt Creek in the southeast corner of the park is important deer winter range. Mountain lions occur in this area as well as in upper Davis and Lavender Canyons.

Page 3-166, Section 3.4.3.1 Existing Air Quality

The site is within in 0.3 km (0.2 miles) of Canyonlands National Park (see table 2-6 and various maps within EA).

Page 3-169, Section 3.4.4. Noise

In paragraph 1, line 4 (third sentence), add running water as a natural source for noise. Change the reference to noise along jeep trails to qualify the statement to say, "Areas in the vicinity of the jeep trails experience occasional high noise levels from recreational vehicle activity." As the state-

ment presently reads, it implies that high noise is a constant occurrence. This is not the case.

Ambient noise level measurements by Bolt, Baranek, and Newman Inc. (BBN) under contract to the National Park Service, indicate lower values than reported in the Paradox Basin Noise Study (BGI, 1983b, ONWI-460). A final report is not yet available, but we have forwarded a copy of a progress report for measurements at eight locations in Canyonlands National Park. The BBN measurements were made in the 125 Hz and 250 Hz one-third octave frequency bands, while the BGI measurements were made in full octave frequency bands. Having no expertise in this field, we cannot do the calculations to compare measurements. However, BBN has provided us with some comparative measurements from two sites at our request.

1. Upper Salt Creek (with noise from flowing stream nearby)
   Leq (24 hours) = 30 dBA
   Ldn = 36 dBA

2. Horse Canyon (near Tower Ruin)
   Leq (24 hours) = 19 dBA
   Ldn = 25 dBA

The BBN measurements indicate little variation between day and night sound levels, whereas the BGI measurements indicate more variation between these levels. This would be expected given the different seasons of measurement and the higher level of visitor activity (including vehicles) at BGI sites.

High noise levels where wind is indicated on the enclosed charts should be interpreted with caution. The high levels may be unavoidable "artifacts" of noise created when the wind passes over the microphone. We know of no way to adequately differentiate the "artifact noise" from the "real noise" of the wind.

We recommend the National Academy of Sciences guidelines for noise in areas of critical concern be mentioned in paragraph three, even though it is not a regulation.

Page 3-170, Section 3.4.5 Aesthetic Resources

In the third paragraph, the discussion should be expanded to add that the views from several major viewpoints in and out of Canyonlands National Park could be affected. Some of these include Grandview Point, Buck Canyon Overlook, Colorado River Overlook, Pothole Point, and Needles Overlook.

The visual resources of Canyonlands National Park should not be completely disregarded as they are in this section. If anything, it would seem that the resources of Canyonlands should be classified as Class I. We expect DOE to incorporate the superlative scenic resources which were recognized in the park's enabling legislation into the assessment.

Page 3-172, Section 3.4.6.1 Previous Work

In the fourth paragraph add: "in the Salt Creek Archeological District" after "Davis and Lavender Canyons" in order to help the reader place the canyons in context with the archeological district.

While previous work on the cultural resources of Davis Canyon region is limited, and the significance of those resources is not completely understood, caution must be taken not to dismiss them a unimportant. Understanding these resources is particularly important in the context of the Four-Corners region as a whole, and in relation to the Salt Creek Archeological District.

Page 3-177, Section 3.4.6.2 Davis Canyon and Vicinity

In the first sentence of this section, place a period after the citation and delete the phrase beginning "unknown acreages ...". Substitute the following: "National Park Service archeologists surveyed 1,295 hectares (3,200 acres) within Canyonlands National Park; 648 hectares (1,600 acres) of this survey included the head of Davis Canyon within the park. Unknown acreages have also been surveyed in upper Lavender Canyon by local individuals."

The 1983 National Park Service archeological survey was a 100 percent survey which resulted in the recording of numerous sites, including 59 sites and 34 isolated finds within just Davis Canyon. This survey, conducted in a limited portion of the Salt Creek Archeological District, uncovered resources of significance which indicate the potential for more comparable finds both within and outside of the park. The NPS has concern for cultural resources inside and outside of the Salt Creek Archeological District as they are critical to increasing archeological knowledge about the Four-Corners region. Copies of this survey were supplied to Battelle Memorial Institute in early 1984.

The discussion of cultural resources has a very quantitative orientation which lacks a qualitative assessment of their value in the context of archeological knowledge and studies now and in the future. The significance of the Salt Creek Archeological District and associated resources beyond its boundaries merit discussion.

Page 3-191, Section 3.6.2.4 Tourism

This section gives no attention to the effects on the river running industry. This industry is of major economic importance to the area with 18 companies operating through Cataract Canyon alone. Gross receipts for just these companies amount to over $1,000,000 each year.

In 1982-1983, the State of Utah conducted a survey of over 13,000 visitors to southeastern Utah. This was an attempt to assess visitor attitudes towards the placement of a high-level nuclear waste repository adjacent to Canyonlands National Park. Results of the survey indicated that over 80% of the respondents would be less likely to visit the area if a repository were to be located at Gibson Dome. This survey was validated by Utah State University in September, 1984. The discussion here should be updated utilizing both the survey and the validation data.

Pages 3-193 - 3-194, Figures 3-53 - 3-54

The significance of these figures should be described in the text. Their relationship to recreation and tourism should be provided. While they contain valuable information, they are not linked to in a meaningful way to any discussion in the text. These figures should be related to a section on recreation and visitor use patterns.

Page 3-199, Section 3.6.3.4 Recreation

Outdoor recreation in the National Park Service areas of the region and on other lands should be highlighted in this section. The lack of discussion about outdoor recreation in the text implies that this activity is insignificant.

Chapter 4: Expected Effects of Site Characterization Activities

Page 4-1, Section 4.1 Site Characterization Activities

In addition to the "site", this section should include lands (by percentage) within the "candidate area" as well, since many of the site characterization activities will not be limited strictly to the site.

The third paragraph states that DOE would not know precisely what and how much land it would need to acquire for the controlled area until the EPA regulations were finalized, site characterization is completed, and data collected in those studies are evaluated. The EA must evaluate how the suitability of the site would be affected if the controlled area overlaps with the dedicated lands of Canyonlands. As required by 10 CFR 60.121, the controlled area must be located in and on lands that are either acquired lands under the jurisdiction and control of DOE, or lands permanently withdrawn and for its use. We believe the site should be disqualified. This particular issue must be addressed in the EA.

Page 4-14, Figure 4-4

This map should indicate that Canyonlands National Park is a proposed wilderness. Page 1 of 2 and page 2 of 2 should appear in the title block following the figure number.

Page 4-15, Section 4.1.1.1.5 Lower Hydrostratigraphic Unit Test Wells

Five lower hydrostratigraphic unit drilling sites are planned for characterization activities at the Davis Canyon site. However, based on the potentiometric surface of this unit and the locations of these drilling sites shown on Figure 4-4, only one site (DC-1) is planned downgradient of the proposed repository site. This borehole is proposed between the outer boundary of the controlled area and the boundary of Canyonlands. In fact, only two of the five lower hydrostratigraphic unit drilling sites are located west of the GROA.

This limited investigation program downgradient of the site, particularly given the current uncertainties in groundwater flow direction, is not sufficient to adequately characterize the local geologic setting surrounding the site. More specifically, additional boreholes further downgradient, and thus within Canyonlands, would be needed to detect structural, stratigraphic, lithologic, and

geohydrologic variations in the local geologic setting and to better establish direct avenues, preferential pathways, or barriers to groundwater flow. A similar concern also applies to the geographically limited drilling program for the upper hydrostratigraphic unit shown in Figure 4-3.

It should be noted that review of geologic and hydrologic investigations proposed for characterizing other proposed repository sites indicates more standard approaches to geologic and hydrologic investigations, e.g., more even distribution and spacing of boreholes surrounding these sites to characterize the local geologic setting. (See Figures 4-1 and 4-3 of Swisher County EA; Figures 4-1 and 4-4 of Deaf Smith County EA; Figures 4-3 and 4-4 of Vacherie Dome EA; Figure 4-3 of Cypress Creek Dome EA; Figure 3-7 of Reference Repository Location, Hanford Site EA; and Figure 4-3 of Richton Dome EA.) The EA should specifically address how and why more limited and constrained drilling and investigation programs at the Davis Canyon and Lavender Canyon sites will provide sufficient information to adequately characterize these sites.

Page 4-27, Figure 4-8

It is not evident from Figure 4-1 (Schedule of Geotechnical Field Activity), Figure 4-8 (Construction/Testing Schedule for Exploratory Shaft Facility), and Figure 4-24 (Cumulative Site Characterization Work Force) that characterization activities are "phased". That is, the EA does not identify any decision points in the characterization process where acquired information is assessed to determine whether characterization activities should proceed.

For example, the EA does not address whether the results of environmental studies, to more comprehensively evaluate impacts to Canyonlands NP, will be evaluated in terms of acceptability prior to shaft construction. Nor does it make clear that groundwater hydrologic conditions will be ascertained over an extended period of time (1-3 years) to establish baseline conditions. The EA should provide clarification with respect to these concerns. It should be noted that the Department of Energy's recently released Preliminary Draft Project Decision Schedule implies that at the salt site, borehole drilling and shaft construction commence at approximately the same time, thus minimizing opportunities for phased characterization.

Page 4-43.

The fourth full paragraph on this page states that potable water during characterization activities will be "supplied by wells or trucked to the site." This is the first mention in the EA of on-site wells. The EA should describe where such wells will be located and evaluate the expected local effects of these wells. In particular, the effects of such on-site wells to the water resources of Canyonlands NP should be address. (See also reference to on-site wells on pages 4-74, 4-95, and 4-136 of the EA.)

Page 4-67, Section 4.1.3 Other Activities

Further studies should include in-depth investigations to understand the relationship between the impacts of DOE's activities and the experience of recreationists in Canyonlands National Park and surrounding areas to be impacted by DOE activities. These studies should utilize contemporary recreation behavior and sociological methodologies to study recreational use patterns,

recreationist characteristics, expectations, perceptions and satisfaction as they may be altered by DOEs proposed activities. Some of the study categories which should be included are noise, air quality, viewsheds, traffic, opportunities for solitude, and archeological resources.

Page 4-67, Section 4.1.3.1.2 Terrestrial and Aquatic Ecosystems

Based on the sightings of peregrine falcons in Davis Canyon, although none are known to nest in the vicinity of the site, prey species abundance for the peregrine should be determined, as well as determining the hunting range of this endangered species area.

Pages 4-69 - 4-72, Section 4.1.3 Other Activities

This section describes various environmental studies that will be conducted during the site characterization phase. A discussion should be included of when these activities will commence and be concluded and of how the scheduling of activities will assure that critical environmental baseline data is available prior to commencement of any borehole or shaft construction activity. In addition, the site characterization field studies should be described in more detail.

Page 4-69, Section 4.1.3.1.4 Hydrology and Water Quality

The penultimate paragraph of this section (p. 4-71) indicates that groundwater samples will be obtained from existing wells in the vicinity of the site. These wells and any wells within Canyonlands NP which would be sampled should be identified.

Page 4-71, Section 4.1.3.1.6. Noise

In the first paragraph, analysis should be made of air transportation requirements for workers, officials, and guests. If the Canyonlands resort or any other nearby airstrip is considered, then noise impact studies should be accomplished. Travel for such studies in the park would be limited to existing roads only.

It is not clear to us whether the two-season noise survey will be conducted before or during noise producing field activities of site characterization. We recommend it be conducted before other field activities, because the sound level data should be used in the analysis of impacts due to site characterization as well as repository construction and operation. The background sound level data reported to date are insufficient to make any meaningful analysis of noise impacts.

Since the noise impacts will primarily affect park visitors, we urge survey points also be located in the park. We also suggest a statement on the purpose of the noise impact analysis. This section only mentions obtaining background sound levels at the Davis Canyon site. If that is the case, an adequate impact analysis is not possible.

Page 4-72, Section 4.1.3.1.8 Archeological, Cultural and Historic Resources

In the last paragraph, add consultation with the National Park Service because of possible indirect effects of resources within Canyonlands National Park and the proximity of the Salt Creek Archeological District.

Page 4-73, Section 4.1.3.1.10 Transportation and Utilities

The movement of radioactive materials into the storage area would be across the Navajo Reservation through two or three of their larger populated communities. There is also heavy traffic through the eastern and northeastern portion of the reservation with the probability of vehicular accidents and possible spillage due to accidents. This could pose potential health hazards to the area residents and must be addressed.

Specific transportation accident measures must be developed if there is a potential for spills on the Navajo Reservation. The potential problems relating to jurisdiction on the Navajo Reservation should evaluated.

Page 4-75, Section 4.1.3.3 Land Acquisition

Since the National Park lands are within 1,000 feet of the site, it appears obvious that field studies would be required within the National Park. It should be noted that only those studies that will have no impact on park resources or visitors will be allowed. A cooperative agreement between the National Park Service and DOE would be required in addition in any DOE-BLM agreement.

The statement "DOE may grant the surface owner(s) the right to continue their present activities" infers that public access across the site to the Davis Canyon portion of Canyonlands National Park "may" be permitted. The site, as depicted in this EA, totally blocks vehicular access to upper Davis Canyon. The EA must address what course of action would be taken by DOE if access were not allowed.

Page 4-76, Section 4.2.1.1 Effects on Land Use and Mineral Resources

The EA should address the impacts from the possible withdrawal of public rights-of-way.

Page 4-76, Section 4.2.1.1.1 Geologic Field Studies

In the first sentence, we suggest deleting the phrase "short term and temporary," since no definite estimate is given nor can one be made, about vegetation recovery in this region. Additionally, the document does not conclude that impacts to archeological resources would be temporary.

After the first paragraph of this section, add "The boundary of Canyonlands National Park would be surveyed and marked to assure that field studies do not extend into the park."

The third paragraph of this section indicates lack of data in the statement "major disturbance will be livestock." Only 250 cattle are present for part of

the year; hundreds of people are present throughout the year in the park and vicinity.

Page 4-77, Section 4.2.1.1.2 Exploratory Shaft

We disagree with the second paragraph, first sentence. It should be changed to reflect the fact that the primary land use is recreation and the primary land use impact would be on recreation. Compare approximately 250 cattle/year and in excess of 830 people per year using Davis Canyon.

At the end of this section, add a new paragraph as follows: "Nevertheless, when taken in conjunction with effects of air quality, noise, aesthetics, and proximity of cultural resources, the exploratory shaft and the proposed access route have potential for adverse impacts on the recreational use of the park." (See Sections 4.2.1.11 and 4.2.1.12.)

Page 4-78 - 4-79, Section 4.2.1.2 Effects on Terrestrial and Aquatic Ecosystems

The EA states that impacts to wildlife would be minimal because wildlife would simply shift to adjoining habitats. On what data is the conclusion based? Traffic and increased human activity is likely to alter adjoining habitats as well. Desert bighorn in Lockhart Basin and adjacent areas in the park are of particular concern. Drilling and human use in Lockhart Basin could significantly disrupt these animals existing in already harsh conditions.

The dismissal of impacts to wildlife as temporary and therefore insignificant is unsubstantiated. The NPS is not convinced that the impacts to some of the larger ungulates, particularly bighorn sheep, will be temporary.

Page 4-80, Section 4.2.1.2.3 Threatened and Endangered Species

In the second sentence, the distance to the nearest known nesting site of peregrines is approximately nine miles, not ten. The kilometer distance should be adjusted accordingly.

Page 4-84, Table 4-21

The EA should project SO_x emissions during ESF construction.

Page 4-85, Section 4.2.1.3.1 Air Quality Modeling Methodology

The statement concerning the development of the VALLEY model is incorrect. The VALLEY model was developed for analyzing smelter and other large source, control strategies. The model was applied to these sources, including area sources, with quite close elevated terrain. DOE's statement is more appropriate for how the VALLEY is used now for screening.

Page 4-86, Section 4.2.1.3.1 Meteorology

The worst-case meteorology selected for the ISCST, ground-level release, flat-terrain model application, is the source as would be used in VALLEY model screening for an elevated point source near elevated terrain. DOE should demonstrate that that is worst-case meteorology for ISCST. Furthermore,

because there is no meteorological data at the site, how does DOE know that the worst-case conditions they assumed will only occur once per year? Furthermore, given the reported high percentage of stagnation or calm wind conditions for this area, local terrain effects such as mountain-valley wind systems could dominate the wind pattern in the absence of a strong synoptic flow. This could lead to concentrations higher than those estimated to occur in the DEA.

The discussion of the use of "F" stability, and "D" stability for elevated terrain is poorly worded, and it is difficult to understand exactly what is meant.

Pages 4-88 - 4-93, Section 4.3.1.3.2 Air Quality Consequences

The entire discussion concerning the nighttime visual impact due to illumination of the facility (now included in "Effects on Aesthetic Resources" on pages 107-109) must be included in the air quality effects section. Impacts on the night sky of Canyonlands NP constitute an impact on an air quality related value (AQRV) of the park. An AQRV is defined as a value possessed by an area that may be affected by changes in air quality. In the EA, DOE acknowledges that:

(1) Canyonlands and vicinity are noted for the "spectacular night sky vistas and the feeling of solitude experienced by visitors in its pristine night environment" (page 4-107); and

(2) "nighttime visual impact, due to skyglow facility illumination will have the potential to affect significantly larger numbers of visitors, particularly during periods when the particulate content of the atmosphere is elevated" (page 4-109).

Therefore, night sky views must be considered an air quality related value of Canyonlands NP. This change should be reflected in other section of the DEA including Summary tables and discussions.

Page 4-89, Section 4.2.1.3.2 Air Quality Consequences

The estimated, worst-case 24-hour TSP concentration within the park is five times the PSD class I increment. The worst-case condition is assumed to occur once per year or less. DOE should include a discussion of other conditions which may occur more than once per year, but which would cause concentrations to be greater than the increment by, perhaps, a factor of two, or something less than a factor of five.

Page 4-93, Section 4.2.1.3.2 Visibility

The visibility analysis is not acceptable. By using an adjusted value to reflect a very short travel time, the Level-I analysis is not a screening tool, i.e., a source could pass the Level-I test but fail Level-II. Therefore, a Level-II analysis should have been performed for the short distances of concern. The geometry of observer, plume, sun and vista are critical in the analysis. DOE should include a complete discussion of assumptions made.

Page 4-97, Section 4.2.1.5.1 Soils

The reports should contain tables listing the amount and kind of vegetation that will be disturbed by construction and characterization activities. These tables should include the activity, e.g., boreholes, roads, rights-of-way, buildings, etc., and the amount of each vegetation type to be affected by each activity. In addition, the tables should be divided into site characterization and construction. Example:

Acres of Each Vegetation Type Disturbed

Activity	Galleta	Shadscale	Juniper	Riparian	Total
1. Boreholes					
2. Road					
3. Rights-of-way					
TOTAL					

Finally, the text should clarify the acreage of vegetation types disturbed.

Page 4-98,

It is unclear why a salt emission rate (SER) of 9 times the average SER and 2 times the peak emission rate is expected to have insignificant effects offsite. Section 4.2.1.5.1 (David Canyon) Field Studies - says "Approximately 34 hectares (85 acres) of land ...". The vegetation type of the land should be specified.

Page 4-99, Section 4.2.1.6 Noise Effects

In the second paragraph, after the tenth sentence, add: "However, any noise identified with the project which exceeds the ambient noise levels in the park would be a significant adverse impact to park values of quietness and solitude."

The indicators of noise impact used in this analysis are inappropriate and inadequate for assessment of the noise impacts on visitors to Canyonlands National Park, even though modifications were made i an attempt to adapt to a situation unlike any for which the indicators were developed. The third sentence in the first paragraph is misleading. EPA says that the Ldn of 55 dBA is related to "quiet outdoor residential areas" (urban and suburban), not just "quiet outdoor areas" as stated. The same EPA reference (page 31) referenced here in the EA does address the Davis Canyon situation as follows:

> "The unpopulated areas include wilderness areas, parks, game refuges, and other areas that are set aside to provide enjoyment of the outdoors. Although quiet is not always of paramount importance in such areas, many individuals enjoy the special qualities of serenity and tranquility found in natural areas. At this time it is not possible to identify an appropriate level to prevent activity interference and annoyance. However, when it becomes possible to set such

a level, a clear distinction should be made between natural and man-made noise."

In the third paragraph, the EA points out that the method used may be statistically less meaningful when applied to Davis Canyon than in the large community context for which it was designed. We do not see how it can be meaningful at all. The EA does not address the differences in "large community" situations and "unpopulated areas" (wilderness areas and parks) identified by EPA. No attempt has been made to distinguish between natural and man-made noise, for example.

We believe it is possible, though difficult, to identify an appropriate noise level or noise phenomenon for preventing activity interference and annoyance in Canyonlands. However, new ground must be broken in the field of noise impact analysis in order to do it. Surely, noise study has developed new insights and methods in the ten years since the EPA reference was published.

We reviewed the Shultz (1978) reference mentioned in the third paragraph, and agree that the percentage of "highly annoyed" is probably the best way to assess noise impacts. However, his finding was based on analysis of more than 18 social surveys in urban areas. What is needed are social surveys in parks and wilderness areas to determine what noise is "highly annoying." We suspect that it would relate more to noise detectability and the identification of that noise with a man-made source.

Shultz (1978) believes that the number of complaints in a population is probably comparable with the number of people who are truly highly annoyed. If that is the case, we can demonstrate that at least some park visitors would be highly annoyed, even at Ldn noise levels at 36 dBA or below. During the drilling of GD-1 on Indian Creek in 1980, two written complaints and numerous oral complaints were made by visitors who heard the drill rig while they were in the park. The park boundary was roughly five miles from GD-1, and some visitors complained about hearing the noise when they were at least ten miles from the drilling activity. A ten mile radius around the Davis Canyon site encompasses the entire core use-area of the Needles District. By relating previous accounts of hearing GD-1 to the distance between Davis Canyon and the core use-area of the Needles District, it can be concluded that a high percentage of park visitors would hear the noise (possibly approaching 90-100%). Determining what percent of these visitors would be "highly annoyed" would require survey studies, but it seems clear to use that there would be some visitors who would be "highly annoyed", with a possibility of the percentage being fairly high.

As Shultz (1978) notes, nonacoustical variables play an important role in determining individual annoyance and complaint reactions.

> "It is even suggested that noise exposure itself is one of the least important determinants of people's propensity for noise annoyance, that one can more accurately predict whether an individual will be annoyed by noise from a study of his personal traits rather than by measurement of the noise to which he is exposed."

While the nonacoustical variables may be more difficult to measure than noise variables and their interference with speech, sleep, etc., we believe they are

more appropriate to noise impacts on park visitors. We note that the activities against which noise interference has been measured include conversation, sleep, rest, and work. While we would be concerned if noise affected these activities for park visitors, the activities most likely to be affected relate to the values visitors attribute to the park.

EPA identified one aspect of those values in its 1974 report: "... the special qualities of serenity and tranquility. ..." In an NPS funded study (Ross, David M., et al. 1985), one finding was that park visitors felt naturalness was the most important of park attribute. Naturalness was more important to their recreational experience than the specific attributes for which the parks are famous. The study was concerned with visibility impairment and visitor enjoyment in Grand Canyon and Mesa Verde National Parks, but reasonable inferences can be made about the applicability of the "naturalness" finding to other national parks and about man-made noise as a violation of the naturalness.

In addition to understanding noise and human perception of noise, it is also necessary to examine the recreation experience being sought at a potentially affected NPS unit. In a visitor use study of Utah parks, (Davidson-Peterson Associates, Inc. 1978), there are findings cogent to this discussion on noise effects as well as to other aspects of impacts on Canyonlands National Park.

1. Visitors to the Needles District are more likely to have Canyonlands as a destination (40%) than are the visitors to any other park studies under this variable. Canyonlands--Island in the Sky, 27%; Arches, 5%; Natural Bridges, 4%; and Capitol Reef, 3% (Davidson-Peterson 1978, page 189).

2. 75% of the Needles visitors camp; 44% camp in established campgrounds; 9% camp in backcountry (Davidson-Peterson 1978, page 197).

3. Needles visitors are likely to stay longer in the Needles District (1.58 days) than the visitors to other park areas (0.32 to 1.11 days). 25% stay two days longer and 22% stay three days or more (Davidson-Peterson 1978, pages 205-206).

4. Compared with other visitors to park areas, visitors to the Needles are more likely to report "getting away from other people" (60%) than are visitors to other parks (27%-38%) (Davidson-Peterson 1978, pages 207-209).

5. When asked what they would tell their friends about their Needles visit, 22% mention that the district is peaceful and secluded, where a person can get away. This compares to 10% to 12% for the other parks studies (Davidson-Peterson 1978, page 211).

These data indicate that visitors to the Needles District are highly involved in recreation activities that are likely to be adversely impacted by low-level man-made noise. Visitor exposure to noise from site characterization and repository construction and operation is also greater, thus increasing the likelihood of noise annoyance.

Page 4-100, Section 4.2.1.6.1 Onsite Activities

In the first paragraph, last sentence of this section, we suggest that canyon walls, being bare stone in a multitude of angles and positions, may act more as reflectors and transmitters or magnifiers of noise rather than as barriers. There is little vegetation to absorb noise. Specific onsite studies are needed to determine noise impacts. We do not believe there is a model adequate to represent the existing situation.

Page 4-102, Section 4.2.1.6.1 Onsite Activities and Section 4.2.1.6.2 Offsite Activities

Based on actual experience, as reported by park visitors (see comments pertaining to page 4-99) and Park Rangers, the distances given for noise audibility are grossly underestimated. As pointed out in earlier comments above, noise from GD-1 drilling was audible and highly annoying to park visitors 10 miles away and behind cliff barriers that the BGI model states will deflect and reduce sound travel. The noise from GD-1 was easily audible to Park Rangers eight miles from the drill site at the Needles Ranger Station.

The criterion for audibility used in the second paragraph on this page (page 102) is misused. The National Research Council's 1977 Guidelines for Preparing Environmental Impact Statements on Noise specified criteria (5dB below the existing hourly average sound level) is one in which speech interference, not annoyance is of primary concern. Note that the specific example given in that document is an outdoor amphitheater. In reviewing the criterion table (Table VI-1, page VI-4) in the National Research Council document, it is obvious that all the land uses listed are urban or in populated areas, including parks (city parks, since the criterion is an Leq dB of 60) and the "Special Purpose Outdoor Areas" criterion has no connection with the annoyance impact on a park visitor's enjoyment of quiet and solitude.

Please note on pages VI-11 and VI-12 of the National Research Council Guidelines that degradation of the environment is addressed for areas where no people are presently living (parks, wilderness areas). It states that, "As a supplement to any numeric quantification, a word description of the environmental impact should be stated in terms of the expected change from the present conditions." We feel this has not been adequately done, but believe that the information we have provided in our comments can help in this regard.

Page 4-103, Figure 4-19

As noted in the previous paragraph, this is not applicable to an adequate assessment of noise impacts on Canyonlands. The Leq (equivalent level) gives more significance to high levels than to low levels; as a result, it tends to overestimate the role indigenous levels play in masking man-made sounds (Foch and Oliver 1980, page 8).

In a Bryce Canyon National Park study (Foch and Oliver 1980, page 39) on the assessment of mining noise impacts, it was found that mining sounds would be audible whenever any of their octave band levels reach a level eight decibles less than the overall equivalent level of the indigenous (background) sounds. Masking of mining noises was predicted to occur infrequently.

Because of the disparity between our observations as noted above and the results obtained from models used by BGI and DOE, we can only conclude that the model is inappropriate or faulty. An adequate assessment can only be done by performing sound propagation tests and study at the site. Propagation tests should be preceded by a study design which has passed rugged peer review.

An analysis in which the principal product is an A-weighted noise contour is completely inconsistent with the scientific basis for the method of predicting audibility used by Harrison, et al. (1980). New information about the audibility of low frequency, broadband sounds (Fidell et al., 1983) supplants information available to Harrison et al., and improves reliability of assessed impacts. The methods of Harrison et al. are specifically designed for predicting noise impacts on recreation. It is much more appropriate than the methods used by DOE.

A-weighted measurements of source levels do not contain the information necessary to calculate the detectability of broadband sounds heard in the presence of broadband ambient noise. Several different sounds can have the same A-weighted level, but all have different degrees of detectability (Karl Pearsons of Bolt, Beranek, and Newman, Inc., personal communication 1985).

It is incorrect to say (ONWI-460, page 15) that "... a noise source which produces sound similar to the background noise is generally audible only when its sound pressure level exceeds that of the background noise." Sounds can be heard below the level of background noise (Karl Pearsons of Bolt, Beranek, and Newman, Inc., personal communication 1985).

Page 4-104, Section 4.2.1.7 Effects on Aesthetic Resources

Impacts on visual resources exist regardless of human presence; it is the interpretation and valuation of these impacts that require human observers. The EA only addresses the visual and viewshed aspects of aesthetics in this section, disregarding other components of the region which in combination comprise the total of the aesthetic values as experienced and interpreted by park visitors. In addition, this section states that only a few visitors would be affected due to the very low visitation in repository-related areas. As the NPS points out in the overview of concerns section, to dismiss impacts because they only affect a few visitors is to neglect the established purpose of Canyonlands National Park as wildland recreation area.

Page 4-105, Figure 4-20

It would be very helpful to mark the major viewpoints in and out of Canyonlands National Park on this map. This will assist the reader in relating DOE activities with viewsheds.

Page 4-107, Section 4.2.1.7 Effects on Aesthetic Resources

In its visibility analysis within the park, the BLM analysis failed to include the views from the two most critical areas of Pothole Point and Colorado River Overlook road.

Although site locations for boreholes, drilling, and meteorological towers were changed, visual impacts of these activities should not be dismissed.

Pages 4-107 and 4-108, Section 4.2.1.7 Effects on Aesthetic Resources

Figure 4-21, which shows perceptible night glow from the proposed site is credited to Stafford, 1984. The figures, unlabeled, appear to be identical to System Applications, Inc. Figures 3-6 and 3-7 of the SAI report prepared for the National Park Service. As mentioned earlier, the entire discussion of night sky effects must be moved to the air quality related values section.

Page 4-109, Section 4.2.1.8 Effects on Archeological, Cultural and Historical Resources

In the first paragraph, after the second sentence, insert: "These indirect impacts could also be earlier in time through increased public awareness of the cultural resource resulting from publicity of site selection activities." This appears to be occurring in the vicinity of the site.

As discussed in the overview of concerns, the NPS does not feel assured that education will protect these resources. Also, what will the impact of blasting and other earth vibrations be on these resources?

Page 4-110, Table 4-24

The Class III survey performed in eastern Canyonlands National Park should be referenced. Copies of this survey were supplied to DOEs contractor in early 1984.

Page 4-113, Section 4.2.1.8.1 Exploratory Shaft Facility

In the fourth paragraph, the sites in question within Canyonlands National Park have already been designated and are included on the National Register of historic places as part of the Salt Creek Archeological District.

In the fifth paragraph, add the National Park Service to the list of agencies to be consulted due to the proximity of the Salt Creek Archeological District. We suggest deleting the seventh paragraph and substituting: "The Salt Creek Archeological District coincides with the southeastern corner of Canyonlands National Park, and includes all of the heads of both Davis and Lavender Canyons within the park. Indirect impacts of disturbing or damaging archeological resources in this part of the district could be expected from increased activities related to site characterization. While activities detrimental to cultural resources cannot be totally eliminated, they can be reduced through education, prevention and conservation measures. (NPS, 1984)." The reference for this statement is: U.S. Department of the Interior, National Park Service, Griffin, Dennis P., 1984, "Draft Archeological Inventory Survey, Salt Creek Archeological District: Areas Adjacent to the Nuclear Waste Repository Site," 432 pp., Lincoln.

The Salt Creek Archeological District is within 1,000 feet of the site, making it easily accessible from that locale. 59 sites and 34 isolated finds have been recorded on park lands in upper Davis Canyon alone.

Page 4-115, Section 4.2.1.10 Effects on Transportation and Utilities

The EA should address whether the drill rig for the exploratory shaft can even negotiate portions of U-211 without some modification of the road alignment. Has this problem been studied? Was the proposal to construct a new road via Harts Draw applicable only to the repository and not to the site characterization phase?

Also, see above comments for Sections 4.1.3.1.6 and 4.1.3.1.10.

Page 4-117, Section 4.2.1.11 Effects on Tourism and Recreation

In the third paragraph, add: "one effect of the repository and its associated impacts would be to limit future options for recreation management in backcountry areas adjacent to the Davis Canyon site. For example, at some time in the future there may be an increased demand for wilderness experience opportunities. One way to meet that demand would be to construct trails through park areas such as the one adjacent to the site. Presence of the site characterization activities would preclude such management action because of the site and its impacts would negate the values for which the park was established."

Page 4-122 - 4-124, Section 4.2.1.12 Summary of Impacts to Canyonlands National Park

Refer to overview of concerns presented at the beginning of these comments.

Page 4-122, Section 4.2.1.12 Summary of Impacts to Canyonlands National Park

In the thirteenth paragraph, first sentence, delete the first phrase "Park ... activities," and substitute the following: "The impact of the site on park recreation cannot be based solely on the number of park visitors affected. The values of solitude and wilderness character are greater in areas of lower visitation. Thus, the effects of the repository site on the remote, little visited sections of the park adjacent to the site may seem minimal because of the low number of people involved. In reality, the isolated nature of the area magnifies sounds and activities so they affect the designated use of a sizeable area which has been identified as possessing the solitude and wilderness character for which the park was established. In effect, the presence of the repository site would shrink the size of the park. A portion of it would no longer be available to use for its intended purpose."

Page 4-123, Visibility

The summary paragraph concerning visibility impacts may need revision once the Level-II analysis is performed.

Page 4-124, Night Sky

The statement that "nighttime aesthetics will also be minimally affected by site characterization activities and structures" is inconsistent with previous statements that "night" lighting is likely to result in degradation of the visual character of the night sky" (page 4-107), "some visitors will consider illumination impacts objectionable and visually intrusive" (page 4-107), and the characterization of night glow effects as a major source of environmental effect

which could impact the park visitors' experience (page 4-118). Night sky illumination is highly likely to affect a substantial number of visitors.

Page 4-126, Section 4.2.2 Expected Socioeconomic Effects

DOE's plan to allow grazing and other surface activities to continue may be in conflict with 10 CFR 60.121.

Page 4-133, Combustible Refuse

"Combustion in an approved onsite incinerator" with disposal offsite is indicated as the preferred disposal method for combustible refuse. Contrary to the assertion contained in this section, there is no specific reference to this emissions source in the air quality discussions elsewhere in the EA.

Page 4-137, Table 4-31

The following statement should be included in this section: "Indirect impacts are expected to occur to sites on the National Register of Historic Places as well as to sites eligible for listing on this register."

Page 4-139, Table 4-31

See comment for page 4-137.

Chapter 5: Regional and Local Effects of Locating a Repository at the Site

Page 5-2, Section 5.1.1.1 Repository Site Layout

In the second paragraph, the EA states that the controlled area could extend out as far as 10 kilometers (6.2 miles), but it is likely to be much less than this. The EA should describe the relationship of the controlled area to the dedicated lands of Canyonlands National Park. (See comment for Section 4.1 above)

The EA should discuss the likelihood of the control zone extending over the National Park boundary.

Page 5-13, Figure 5-5

The relationship of the underground layout to surface feature and topography should be shown.

Page 5-15, 5.1.1.5 Repository and Land Acquisition

This section should recognize the possibility that the site could extend into the National Park since the controlled area has not yet been determined.

Page 5-35, Section 5.1.5.3 Active Monitoring

The EA notes that while post-closure monitoring requirements have not been established by the Nuclear Regulatory Commission (NRC), it is possible that such requirements would be instituted. DOE should discuss this matter with NRC. It appears that the close proximity of Canyonlands NP, particularly its

location downgradient in the most likely direction of groundwater flow, would present serious limitations to post-closure monitoring activities.

Page 5-36, Section 5.2.1 Geologic Conditions

The second paragraph states that subsidence up to one foot may occur over the repository. The basis for the statement indicating that this amount of subsidence will not significantly alter groundwater flow patterns should be presented. It is unclear if the potential exists to adversely affect wells and springs in Canyonlands NP, e.g., springs discharging from the Cedar Mesa Sandstone and the Elephant Canyon - Halgaito Formations (Undivided) in the park.

The third paragraph of this section discusses a thermally induced uplift of up to one meter after 1,000 years in the site area, decreasing to zero with a 2-3 mile radius around the site. Based on this information, it appears that this uplift will affect portions of Canyonlands NP. The EA should describe how the surface water and groundwater resources of the park will be affected. Will shallow groundwater resources on which Canyonlands NP is dependent be adversely affected? Also, it is not apparent that this uplift was considered in sizing the controlled area around the site.

Impacts of thermal uplift on archeological features should be evaluated.

Page 5-38, Section 5.2.1.1.2 Operation

This section mentions that soil salinity will be monitored during repository construction and operation. More information should be provided about methodology, frequency, etc.

The fifth paragraph of this section states that salt impacts to soils will be limited since there is "relatively high precipitation in the region and its fairly even distribution." This does not appear representative of the hydrologic regime at the Davis Canyon site, as discussed previously.

Page 5-43, Section 5.2.2.2.3 Decommissioning and Closure

The EA states that a concrete plug and polymer seal ring will be emplaced in the shaft to prevent groundwater inflow into the repository. The integrity of this plug and seal lasting over time should be evaluated.

Page 5-43, Section 5.2.3.1 Land Ownership

The statement "Repository construction may potentially conflict with state owned lands in proximity to the repository site" should be revised to include "National Park Service and private lands." By not including these two groups it is inferred that no potential conflict exists with the land in proximity to the site.

Page 5-44, Section 5.2.3.3 Dedicated Lands

Reference to National Park lands should be made in this section. A casual reviewer would assume that wilderness study area's are the only dedicated lands in the area.

Page 5-44, Section 5.2.3.5 Land Use Plan and Controls

Nowhere in this EA is the issue of co-mingling of defense and civilian nuclear wastes discussed. If the President accepts the recommendation by DOE that wastes be co-mingled, assumptions could be made that the physical size of the repository would be increased and that substantial additional security facilities and personnel would be required due to the classified nature of defense wastes. Impacts of these possibilities although speculative should be discussed here and in other appropriate sections of this EA, particularly as they relate to the administration and resources of, and access to, Canyonlands National Park. Examples of possible impacts include blocked access to Davis Canyon, increased night sky illumination, increased security, and increased size of the controlled area.

Page 5-45, Section 5.2.4.1.1 Construction

This section should include a discussion of how many acres of what type of vegetation will be disturbed by the railroad, access road, etc.

In the second paragraph, the sentence beginning "These activities are all ..." is somewhat misleading. It should read: "While these activities are all actively encouraged by park management, such use can result in unacceptable adverse impacts to biota, thus creating additional management problems for the park."

Page 5-49, Section 5.2.4.3.2 Operation

In the first paragraph, discussion of bald eagle and peregrine falcon should be separated, because the situation is somewhat different for each. The 10-15 miles data is probably true for the bald eagle. However, National Park Service observer has seen a peregrine about 6.5 miles from the site and Dr. Clayton White has observed an apparent peregrine kill of prey in the same locality. A nesting site also occurs in the park about nine miles from the site. It is possible that the area around the site is used as a hunting area by peregrines, but to what extent if any is unknown. Further studies are needed.

In the second paragraph, reference to bighorn sheep should be addressed in Section 5.2.4.1.2, because bighorn are not threatened or endangered species.

Page 5-53, Figure 5-12 24 Hour TSP Map

We suggest that isopleths of 25, 20, 15, and 10 be shown on this map.

Page 5-56, 24-Hour TSP

Figure 5-15 has the same isopleth labeled with two concentration values, 10 ug/m^3 and 20 ug/m^3. This inconsistency should be resolved.

Page 5-59, Section 5.2.5.3 Operation

In the second paragraph of this section, similar modeling and discussion should be included for SO_2, or if not, the reason for omission of modeling should be given in the EA.

Page 5-63, Section 5.2.5.5.2 Salt

An analysis of the cumulative impacts of salt deposition is lacking. According to Table 5-9, National Park lands bordering on the site might expect between 5.3 and 11 pounds per acre of salt each year. The cumulative effects of 35 years of this deposit rate could have a significant impact on the National Park ecosystems. Cumulative effects from salt deposition should be presented in the EA.

Winds tend to be strongest during the Spring when they blow from the south, southwest. There is concern about the potential for salt blowing into the Salt Creek drainage, and subsequently affecting everything in it as it flows to the Colorado River. This is of particular concern as it relates to the endangered Colorado River Squawfish. As a result of field investigations in the summer of 1984 in which six young-of-the-year were caught at the mouth of Salt Creek, this drainage has been identified as habitat for Colorado River Squawfish larvae and young-of-the-year fish. U.S. Fish and Wildlife records indicate that over 50% of larvae and young-of-the-year in the upper stretch of the Colorado River (from Lake Powell to Grand Junction, Colorado) occur inside the boundaries of Canyonlands National Park (Personal communication; John Carter, Ecosystems Research, Inc., Logan, Utah and Lynn Kaeding, U.S. Fish and Wildlife Service). The implications of salt contamination in this fragile habitat has been completely overlooked, and should be addressed.

Page 5-66, Sections 5.2.5.6.1 and 5.2.5.6.2 Visibility

The visibility analysis is not acceptable. By using an adjusted value to reflect a very short travel time, the Level I analysis is not a screening tool, i.e., the source could pass Level I but fail Level II. Therefore, a Level II analysis should have been performed for the short distances of concern. The geometry of observer, plume, sun and vista are critical in the analysis, and DOE should provide the reader with assumptions used. If visibility impacts change as a result of performing the analysis in an acceptable manner, all summary tables and discussions will need to be revised to reflect the change.

Page 5-66, Section 5.2.6 Aesthetic Conditions

This discussion is strictly limited to visual values. This heading should be changed to "visual conditions" and mention should be made that other aspects of aesthetics are not evaluated.

Page 5-67, Aesthetic Conditions

As mentioned in Chapter 4, night sky must be identified as an air quality related value. In addition, DOE should state clearly that night lighting will remain relatively constant during repository construction and operation (i.e., for almost 30 years) and that all of the impacts on Canyonlands NP associated with nightglow, as described more completely in Chapter 4, will continue during this time period.

Page 5-68 - 5-74, Section 5.2.7 Noise

Our comments on Section 4.2.1.6 apply to this section as well.

In Figure 5-25, page 5-78, the "50% of Daily Visitors" isopleth is roughly equivalent to the core-use area of the Needles District as discussed in our comments on Section 4.2.1.6. As we pointed out, there would be some percentage in this area "highly annoyed", and the number could b fairly high although proper social surveys and studies would be required to determine this percentage.

Page 5-74, Section 5.2.8 Cultural Resources

Add the National Park Service to the list of agencies to be consulted since the National Park System sites could be impacted.

Page 5-74, Section 5.2.8.2 Operation

The section referred to in this paragraph (4.2.1.8) is inadequate, particulary with regard to the discussion of direct impacts. (See previous comments on effects on cultural resources.) Since many of the cultural resources subject to impact are within the park, the National Park Service should be added to the list of consulting agencies.

Page 5-75, Section 5.2.10 Tourism and Recreation

We suggest the following language to add to discussion in this section: "One effect from the repository and its associated impacts would limit future options for recreation management in backcountry areas adjacent to the Davis Canyon Site. For example, at some time in the future there may be an increased demand for wilderness experience opportunities. One way to meet that demand would be to construct trails thorough park areas such as the one adjacent to the site. Presence of the site facilities would preclude such management action because the site and its impacts could negate the values for which the park was established."

The use of the phrases "effect if uncertain," "cannot be quantified," "impossible to estimate," and "the only particular that can be estimated" clearly indicate that DOE lacks the data to adequately assess these impacts. In addition, it appears that little attempt was made to utilize existing social sciences methodologies for studying tourism, recreation, and park visitors.

Page 5-75, Section 5.2.10.1 Environmental Impacts on Park Experience

After the first paragraph, add our comments above for Section 4.122.

Visitors did not list nighttime viewing as a reason for visiting because it was not included as an option under the multiple choice format of the survey. DOE fails to mention that 60% of the respondents listed visibility related reasons for their visit to the Park.

Obviously, cumulative impacts have not been addressed since noise was the only impact analyzed.

Page 5-77, Figure 5-24

This depicts the Lavender Canyon site, not Davis Canyon.

Pages 5-77, 5-78, 5-80, Figures 5-24, 5-25, and 5-27

These should show percentage of Needles District visitors affected to more accurately reflect true impacts. The remainder of the park is outside of (we hope) the sphere of noise impacts discussed. Figure 5-26 is the exception, but again, the number highly annoyed is undoubtedly higher and should be included out to the "100% of Daily Visitor" isopleth.

Page 5-81, Section 5.2.10.4 Socioeconomic Impact

The analysis totally ignores one of the largest segments of the recreation industry--river running. This industry in Canyonlands National Park alone accounts for more than the total figures mentioned in section 3.6.2. Percentages expressed throughout this section are rendered totally meaningless due to the lack of consideration of full dollar values.

The statement "1.2% of the annual park visitors would avoid the park" is in conflict with the State of Utah 1982-1983 Visitor Use Survey which indicated that over 80% would be negatively affected. This survey was validated by Utah State University in their September 1984 document Validation of the State of Utah Visitor Survey on Canyonlands National Park.

See comments referring to page 3-191, Section 3.6.2.4.

Page 5-82, Section 5.2.11 Summary of Impacts to Canyonlands National Park

We believe the summary is incomplete. For example, noise and visibility impacts of the transportation routes have not been evaluated according to section 5.3.2.1.6 and 7.

Wildlife in the construction area would be eliminated. There are comments in the documents that wildlife would be "temporarily displaced." Surrounding habitat normally is already occupied to capacity and cannot support animals that are displaced.

The EA states that geologic resources of Canyonlands will not be affected because the repository and its access corridor are located outside of park lands. This statement does not account for the area of thermal uplift which is projected to include the lands within the park (see page 5-36). Paragraph four of section 5.2.1 of the EA clearly states that uplift subsidence will occur within the Park. Paragraph two of this summary section should recognize and review this.

This section should also include a discussion of impacts related to the concentrated dramatic influx of workers for repository construction and operation. We are unaware of any data collection or systematic investigations or analysis of the recreational use patterns or preferences of these workers. The National Park Service has concerns about how these worker characteristics relate to existing recreational opportunities, and natural and cultural resource protection. It is possible that worker influx could alter existing opportunities and increase the likelihood of archeological vandalism. See also, comments under page 5-122, Section 5.4.3.3.

Page 5-83, Table 5-10

This table identifies impacts to Canyonlands NP due to repository construction, operations, decommissioning, and closure. The table identifies no impacts to the surface water or groundwater resources of the park. At a minimum, this table should include potential changes in the water quality of Indian Creek, the potential of radionuclide release to groundwaters which will travel under Canyonlands NP and possibly discharge within the park or within Glen Canyon National Recreation Area, and disruption of shallow groundwater resources in the park as a result of thermal uplift and/or subsidence.

Page 5-84, Table 5-10

Refer to earlier comments on all noise sections about inadequacy of noise data and noise impact analysis.

Page 5-87, Table 5-10

The statement regarding night sky impacts should be moved to the Air Quality section of the Table on page 5-83.

DOE should consider consulting with the National Park Service concerning mitigation of cultural resource impacts within park boundaries.

Page 5-90, Section 5.2.11 Summary of Impacts to Canyonlands National Park

The first full paragraph states that: "Only a small percentage of visitors go to parks for the single purpose of isolation and communion with nature (a wilderness experience)." It further asserts that most campers have "a preference for activities associated with urban environments and developed facilities." The NPS strongly disagrees with these statements. First, the reasons why most campers visit campgrounds has not been shown to be relevant to why people visit Canyonlands NP. Second, the article referenced in support of these statements does not support the proposition advanced here.

The study conducted by Clark, et al., was aimed at determining whether campers and managers have similar goals and whether they agree about the types of activities appropriate to attaining these goals. The survey was done in heavily-used, easily accessible campgrounds with highly developed features. While most (67%) of the campers surveyed said they preferred to camp in "developed car campgrounds," the vast majority felt that "teaching my children about the out-of-doors (71%, 18.8%), enjoying "solitude and tranquility" (65.4%, 22.4%) and appreciating "unspoiled beauty" (83%, 12.8%) were very important. Note: second parenthetical percentage represents those who thought these experiences where "somewhat important" for visiting highly developed campgrounds. See Clark, et al, "Values, Behavior and Conflict in Modern Campings Culture," Journal of Leisure Research, pages 148 and 149. The only unusual finding in this study was that campers thought they could experience "solitude," "unspoiled beauty," etc. in developed facilities in proximity to other campers.

The authors of the article cited here (Clark, et al. 1971) emphasize throughout the text that their survey applied only to large, intensively developed, highly organized and supervised campgrounds characterized by congestion, noise, and

weekend overflows. None of these characteristics apply to any campground within Canyonlands National Park. The conclusion reached by DOE that "most visitors seek a social interaction with other campers and have a preference for activities associated with urban environments and developed facilities" is erroneous and not supported by Clark, et al. or any other pertinent research.

Page 5-97, Section 5.3.1.3.1 Regional Highway Routing - Davis Canyon, Utah

It is unclear whether topography and weather conditions are included in the regional risk calculations. They are important considerations since numerous truck accidents occur each year along highway 91 between the Colorado River canyon and the Needles turn-off south of Moab. In 1983, several fatalities occurred along this section of road, and one particular curve between Moab and Monticello has become notorious for causing at lease one truck accident each year. These kinds of hazards should be considered and discussed.

Page 5-98, Section 5.3.1.3.2 Railroad Routing

It is unclear whether topography and weather conditions are included in the regional risk calculations. These are important considerations, as explained in the above comment.

Numerous truck accidents occur each year along highway 91 between the Colorado River canyon and the Needles turn-off south of Moab. In 1983, several fatalities occurred along this section of road, and one particular curve between Moab and Monticello has become notorious for causing at least one truck accident each year. These kinds of hazards should be considered and discussed.

Page 5-98, Section 5.3.1.3.2 Railroad Routing

See comment for page 5-97.

Page 5-102, Transportation Corridor/Roadways

This section mentions that for construction and upgrading of roadways an undetermined amount of soil will be disturbed. Estimates should be provided of acres and soil to be disturbed.

Page 5-105, Section 5.3.2.3 Airports

Airport improvements must be identified if their impacts associated with the repository are to be assessed.

Discussion of representative airport developments should be similar to that provided for the transportation corridors. It seems highly probable that the Canyonlands Resort air strip immediately adjacent to the National Park entrance road would be the only feasible alternative for full scale development since it is the only active air strip within twenty-five miles of the site.

Page 5-105, Section 5.3.5 Salt Disposal

There is no discussion of potential adverse effects to aquifers and groundwater from salt disposal in abandoned underground mines.

Page 5-115, Section 5.4.2 Economic Conditions

Impacts to the local economy will be both positive and negative. The loss of 10% of the jobs during year four, as well as inflated real estate and goods and services during "boom" times are examples in which the local economy will suffer.

Page 5-118, Section 5.4.2.1.2 Operation

How will repository operation "continue to stimulate employment" when in years four through seven there will be net "out migration" and a drop in total employment?

Page 5-122, Section 5.4.3.3. Protective Services

The assessment should include an evaluation of additional enforcement needs for the protection of National Park System resources adjacent to the site and to the affected communities.

This section should address the possible need for additional protective services in Canyonlands National Park as associated with the influx of workers for repository construction and operation. Such services would include patrols for resource protection purposes, interpretive facilities and services, and search and rescue support.

Page 5-130, Section 5.5 Implications of Alternative Repository Design Concept

If the decision is made to co-mingle defense and civilian wastes, impacts on repository size and necessary additional security measures should be discussed.

Page 5-131, Table 5-26

In the Alternative Two, Phase Concept, the underground facilities area increases from 1,930 acres (for the EA Reference Design) to 3,359 acres. Under this Alternative Concept, will the controlled area change and will it overlap with the dedicated lands of Canyonlands?

Page 5-133, Section 5.5. Implications of an Alternative Repository Design Concept

Since the restricted zone (site) will be twice as large, the disqualification of the site due to location on dedicated National Park lands may be more probable.

Pages 5-135 - 5-144, Table 5-27

Page 5-13, Item 12: Add "National Park Service" as consultor.

Page 5-140, Item 13: "Minimal effect to park visitation" should be eliminated. Section 5.2.10 clearly indicates that DOE lacks the data to draw such conclusions.

Chapter 6: Suitability of the Nominated Site for Site Characterization and for Development as a Repository

Page 6-2, Section 6.1.2 Use of the Siting Guidelines in Evaluation Site Suitability

In the second and third paragraphs, the meanings of levels 1 and 3 are confusing when it says "the evidence does not (or, conversely, does) support a finding." Which is correct?

Page 6-4, Section 6.2 Suitability of the Site for Development as a Repository Under Guidelines Not Requiring Site Characterization

Regarding the paragraph following Table 6-1, we suggest that if sufficient information is unavailable for a full evaluation of compliance, then complete information should be obtained in order to make a full evaluation and meet the intent of the guidelines.

Page 6-6, Section 6.2.1.1.1 Statement of Qualifying Condition

Under Relevant Data, at the end of the first paragraph, add: "The controlled area cannot extend into Canyonlands National Park because it would be a prohibited, conflicting land use."

The EA indicates that the controlled area could extend 10 kilometers (6.2 miles) in any direction from the underground operations area, potentially encompassing thousands of acres. The EA should address the apparent conflict of the controlled area and dedicated lands of Canyonlands. (See comment for Section 4.1 above.)

It would seem prudent that DOE recognize the possibility (if not probability) that the controlled area could extend into dedicated lands less than 1,000 feet from the geologic repository operations area.

Page 6-7, Section 6.2.1.1.1 Assumptions and Data Uncertainty

DOE must recognize the possibility of the controlled area extending into dedicated land and assess those associated impacts. If DOE has guidance from EPA that indicates EPA standards will define the dimensions of the controlled zone to be less than 1,000 feet from emplaced waste, then that guidance should be included here.

Page 6-7, Section 6.2.1.1.5 Conclusion for the Qualifying Condition

At the end of the first paragraph it should be noted that if a determination should be made to extend the controlled zone into Canyonlands National Park, although this is not presently the case, then a disqualifying condition would be found. See above comments for Section 6.2.1.1.

Page 6-9, Section 6.2.1.2.2 Analysis of Favorable Conditions

Low density of human population in the area is presented as a favorable condition. This is logical from the standpoint of exposing the fewest people to radiation hazards. However, the low density human population causes secon-

dary project impacts to be more severe. In the sparsely populated and fragile environment, the impacts from outdoor activities of 5,150 new people would be proportionately greater than it would be in an area already densely populated.

Page 6-11, Section 6.2.1.3.1 Statement of Qualifying Condition

Under Relevant Data, first paragraph, add: "The site (controlled area) may extend into the adjacent Canyonlands National Park and hence be disqualified. The adjacent Canyonlands National Park contains dedicated lands that cannot be acquired." and reference our above comment for Section 6.2.1.1.1. Again, this insertion will keep the relationship of the significance of the park in focus.

Page 6-13, Section 6.2.1.3.4 Analysis of Disqualifying Condition

The site, depending on the final determination of the controlled area, may have a disqualifying condition. A portion of it may be upon National Park Service-administered lands. Discussion of this possibility should be included.

Page 6-15, Section 6.2.1.4.4 Analysis of Potentially Adverse Conditions

The EA should note that the 100-year floodplain is within the GROA.

Page 6-20, Section 6.2.1.6.1 Statement of Qualifying Condition

Since the Nuclear Waste Policy Act specifically mentions "proximity to parks" as a concern, the acts establishing the National Park Service (16 USC 1-20) and Canyonlands National Park (16 USC 271) are pertinent, and should be included in table 6-2. The reference cited in table 6-2, "16 USC 1901-1912", is not the Organic Act of the National Park Service, rather, it is the "Mining in the Parks Act." The correct CFR reference for the NPS Organic Act is 36 CFR 1-199. DOE Is correct in stating that 16 USC 1901 ("Mining in the Parks Act") does not apply. We suggest that DOE include the correct Organic Act for the NPS, and reevaluate whether this act is applicable to the assessment. We believe that this act is extremely relevant, and should not be overlooked.

Page 6-25, Table 6-2. Statutory/Regulatory Authorities and Requirements

The discussion regarding the NPS Organic Act is totally inadequate. First, the "Purpose and Intent" discussion must include a reference to the 1978 amendment to the Act which prohibits activities "in derogation of the values and purposes" for which an area has been established. The "Requirements," "Compliance," and "Projected Ability to Meet Requirements" discussion should indicate that if DOE decides to characterize the Davis Canyon site or to locate a nuclear waste repository at this site, NPS's ability to carry out its statutory mandates will be jeopardized because the impacts occurring in Canyonlands NP are likely to conflict with park values and purposes.

For the Authority "Organic Act of the National Park Service," the Projected Ability to Meet Requirements should have a footnote stating that should a determination be made to extend the controlled zone into Canyonlands National Park, the requirements would not be met.

See comment for page 6-20.

Page 6-33, Table 6-2 Statutory/Regulatory Authorities and Requirements

The statement "equipment noise above 35 dB is not expected to affect any part of the park" is unclear and appears to be inconsistent with section 5.2.7.

Page 6-34 - 6-37, Table 6-2

The summary discussions under both the Clean Air Act and the Utah Air Conservation Act requirements must be revised to reflect: (1) the results of the Level II visibility analysis; (2) the fact that night sky is an AQRV of the park; and (3) a more complete discussion of the frequency and magnitude of 24-hour TSP concentration levels. (See comments on Section 4.2.1.3.2.)

Page 6-39f, Table 3 Measures to Control Potential Adverse Environmental Impacts

For Air Quality, Acceptability of Residual Impacts should be expanded to add: "Although PSD requirements may be met for the park, any reduction of visibility, an air quality related value, would have an adverse impact on the park." Current results of air quality monitoring do indicate some impairment to Class I air. Refer to EA Section 4.2.1.3. This keeps the air quality issues in context, particularly air quality related values which often may be overlooked.

Page 6-39g, Table 6-2

With the Park located less than 1,000 feet from the site, we question the statement "noise above 35 dB is not expected to affect any part of Canyonland Park." The NPS believes the noise impacts to be unacceptable. The portion of the Park to be most affected is also most popular with visitors seeking solitude and tranquility. Those "often visited places" are sometimes locations where solitude and tranquility are of less importance.

Page 6-39i, Table 6-2

The paragraphs under "Acceptability..." may be in error pending NRC's decision of what is a "significant encumbrance" on the land. The possibility does exist that access to Davis Canyon could be blocked.

Page 6-39, Table 6-2 Statutory/Regulatory Authorities and Requirements

The "impacts" column should be reworded to include sites already on the National Register as well as those eligible for listing. Sites within the National Park are included on the register. Any mitigation plans should include the National Park Service.

We do not agree that indirect impacts will be significantly reduced by training programs. Training by Federal, State, local, and private organizations has had little effect on the protection of archeological resources in Utah. Training and education are negated by artifact values of $5,000 or more.

The National Park Service believes that impacts are unacceptable due to the disturbance and loss of significant resources within the Salt Creek Archeological District.

Page 6-39, Table 6-4 Measures to Control Potential Adverse Environmental Impacts

The table lists potential impacts to the groundwater through hydraulic connection of aquifers, waste water seepage from salt pile and evaporation ponds and mud pits. The level of impacts anticipated should be stated including impacts to well and spring resources.

The table lists as mitigating measures that ground water will be monitored to detect any contamination and identify leaks, spills and discharges. Corrective actions will be taken to mitigate problems as they arise. Since this is generally a reactive type of approach, some discharge of contaminants must occur to trigger the corrective action. The anticipated level of impact in light of the intended corrective actions should be indicated.

An important objective of the monitoring well system is to monitor the quality of groundwater leaving the site. The EA should address how these wells will monitor and protect groundwater resources of the park. In addition, the EA should specifically describe the location of the proposed monitoring wells relative to likely flow patterns of contaminated groundwater to wells or springs in the park.

For Land Use, the last item in Acceptability of Residual Impacts is questionable because Figure 3-6 shows the site and controlled area extending nearly across the width of the canyon.

Page 6-40, Section 6.2.1.6.2 Analysis of Favorable Conditions

Under Evaluation, the "Organic Act of the National Park Service" should be footnoted as per our comments above for Table 6-2.

Page 6-41, Section 6.2.1.6.2 Analysis of Favorable Condition

In the fourth paragraph, the basis for the statement "projected particulate emissions from the site are lower than fugitive particulate emissions caused by vehicular traffic within the Needles District of the Park" is questionable. What studies were performed in order to support such conclusions, and by whom were they conducted? We are unaware of any studies on particulate emissions in the park.

Page 6-42, Section 6.2.1.6.3 Analysis of Potentially Adverse Conditions

Under item (1), the first paragraph, Evaluation, the areas of uncertainty should include the possibility of groundwater flows and contamination flowing into Canyonlands National Park and the Colorado River.

Under item (3), the first paragraph, Evaluation, should be expanded to add: "The potentially adverse environmental impacts that cannot be fully mitigated (air quality, noise, and visual impacts) would conflict with the air quality related values, the solitude and the wilderness character of adjacent Canyonlands National Park. These values relate to the superlative scenic features of the park and to the purpose of preserving such features for the inspiration, benefit and use of the public. (78 Stat. 934)"

The evaluation portion of this section states that the analysis presented in Chapters 4 and 5 relative to the impacts on the park conclude that there is no significant adverse impact on the park. They offer the fact that the Davis Canyon area is not a heavily visited part of the park as a mitigating factor. Figure 3-52, Percentage of Visitors to Total Park Within Selected Areas of the Needles District of Canyonlands National Park (page 3-191), shows the percentage of the total park visitors that go to areas within the Needles District. The figure indicates that nearly 89.5% percent of the total visitors to the park are drawn to some part of the Needles District. All of these visitors are potentially impacted since they must travel over the same access road as the repository at some point of their trip to the Needles District.

The reference to heavy visitorship in the EA reflects a misunderstanding of the nature of the Needles area. Canyonlands National Park has zoned the Needles area as a natural zone featuring wilderness experience and solitude not found in many places in the lower 48 states. The EA should consider the significant deterioration of park values of wilderness and solitude. The discussion should center upon the park's management of the Needles District for wilderness and solitude experiences, not solely on visitation statistics.

The discussion in this paragraph and in sections 4.2.1.12 and 5.2.11 conflict with section 6.2.2.2.3 which states that "noise impacts may be significant" and the "impact on visual aesthetics ... is still considered significant."

The geologic repository operations area lies within 3,100 feet of the eastern boundary of the Park.

Page 6-44, Section 6.2.1.6.3 Analysis of Potentially Adverse Conditions

Newpaper Rock State Park facilities (campsites, picnic sites, etc.) are on the opposite side of the highway, therefore increased traffic would disrupt visitation.

Page 6-45, Section 6.2.1.6.4 Analysis of Disqualifying Conditions

Under item 2, the first paragraph, Evaluation, should be expanded to insert: "However, characterization could determine the possibility of groundwater and contamination flows into Canyonlands National Park that would necessitate extending the controlled area into the park." Such an evaluation would require a reassessment of the finding.

Under item (3) we believe the Evaluation has been reached hastily. We suggest that all the paragraph after the first sentence be deleted and the following substituted: "The discussions presented in Chapters 4 and 5, and in Sections 6.2.1.6.2 and 6.2.1.6.4 indicate that potentially adverse environmental impacts, e.g., air quality, noise and visual impacts, cannot be fully mitigated to avoid irreconcilable conflicts with the air quality related values, the solitude, and the wilderness character which define the features and purpose for which Canyonlands National Park was established. Further studies are needed to verify these indications."

Page 6-46, Section 6.2.1.6.4 Analysis of Disqualifying Conditions

The "site" lies within 0.3 km (1,000 feet) of Canyonlands National Park (see EA table 2.6).

Page 6-46, Section 6.2.1.6.5 Conclusion for the Qualifying Condition

In the third paragraph, the second sentence "This potential adverse condition is present because the Davis Canyon site lies near Canyonlands National Park (Section 6.2.1.6.4)" should be expanded to add: ", and because potentially adverse environmental impacts cannot be fully mitigated to avoid irreconcilable conflicts with the features and purpose for which the park was established."

This description would render inaccurate the last item in the fourth paragraph.

Page 6-72, Section 6.2.2.2.2 Evaluation Process

After the second paragraph, add the following: "An important consideration is the proximity of Canyonlands National Park which was established because of its superlative scenic, scientific and archeological features. These features are preserved for the inspiration, benefit and use of the public (78 Stat. 934). Canyonlands National Park is a unit of the National Park System; the Congress has ascribed high public value and integrity to such units (16 USC 1a-1). At present the controlled zone for the site is not projected to extend into Canyonlands National Park. Should site performance change this projection, a potential remains for the controlled zone to extend into the park, with a concurrent potential for restricting public use of the park to some degree. In any event, noise, dust and visual impacts (from both site and access) have the potential for affecting the resources and visitors enjoyment of the park. Thus for park visitors, especially the 51,000 annual visitors to the Needles District, the purpose of the park may be reduced and its value and integrity may be diminished by the construction, operation and decommissioning of the repository and its access."

Page 6-80, Assumptions and Data Uncertainties

The first paragraph of this section states that existing stratigraphic correlations require verification with additional boreholes between existing locations because it is not possible to define the presence of discrete stratigraphic separation resulting from faults or folds with such large borehole spacing. In the context of characterization, it is highly unlikely that this can be done without drilling within Canyonlands NP.

The fourth paragraph of this part (page 6-81) notes that at the WIPP Site, where the bedrock has both primary and secondary openings, it was shown that porous medium theory and transport models were not satisfactory in calculating mass transport and travel times. Yet, in the next paragraph, the EA indicates that at the Gibson Dome sites, where primary and secondary openings occur, groundwater flow rates and travel times are calculated assuming Darcian conditions (i.e., a porous medium). Given the experience at the WIPP Site, this is not a realistic and conservative approach.

Also on page 6-81 the EA indicates that groundwater flow out of the salt would require drastic alteration of existing conditions. The EA should assess the type and likelihood of mechanisms which could cause this degree of alteration.

Further on page 6-81 it is stated that flow in interbeds above the Leadville is not expected because "likely discharge points, e.g., in the Colorado River, are upgradient from repository and lower levels." Clarification should be provided in the EA as to this reason for lack of flow.

Finally in this part (page 6-82) the EA notes that flow through and travel times in the Elephant Canyon Formation above the repository are not considered because an unrealistic assumption that future conditions are altered to permit upward flow to the Elephant Canyon would be required. The EA states that some wastes emplaced in the host rock will be thermally hot (up to 482 degrees F). Given the small differences in head between the hydrostratigraphic units at the site, the potential exists for thermal buoyancy and the resulting travel of groundwater upward to the hyrdrostratigraphic unit overlying the host rock. It is appropriate for the EA to assess groundwater flow conditions and travel times in the Elephant Canyon to assess the effects of such a scenario.

In regard to the pre-waste emplacement groundwater travel directions, consideration should be given to upward flow from the middle hydrostratigraphic unit to the upper hydrostratigraphic unit based on vertical hydraulic gradient information from nearby petroleum wells (ONWI-290, Figure 9-11). Regional data supports the contention that typical hydraulic gradients are both upward and downward from the middle hydrostratigraphic unit.

Page 6-82, Section 6.3.1.1.2 Analysis of Favorable Conditions

The third paragraph estimates the pre-waste emplacement groundwater travel time along the path of likely radionuclide travel to the accessible environment, considering flow downward through the host rock and through primary porosity zones of the Leadville limestone, to be from about 137,000 to 239,000 years. The EA should state that given the range and variability of available data, e.g., for hydraulic conductivities and hydraulic gradients, and the modeling assumptions, estimates of travel times of ground water and radionuclide transport may vary by several orders of magnitude. It should also be noted that the estimated groundwater travel times vary throughout the document.

With respect to estimating groundwater travel times, a more appropriate and conservative approach would consider some "drastic alteration" in the salt, e.g., dissolution or fracturing, and then calculate groundwater travel times to the accessible environment in the upper and lower hydrostratigraphic units, taking into account secondary permeability, e.g., highly permeable linear features in the Leadville Limestone and also higher permeability due to dolomitization. This would provide a more realistic and conservative assessment of the range of possible groundwater travel times to the accessible environment. The results of this type of assessment should be considered in the post-closure ratings of Chapter 7.

Further in this section (page 6-83), the EA discusses Guideline 960.4-2-1(b)(3) which is a favorable condition that applies to sites that have stratigraphic, structural, and hydrologic features such that the geohydrologic

system can be readily characterized and modeled with reasonable certainty. In the EA, groundwater flow rates have been determined assuming Darcian conditions. However, as indicated previously in this review, such a modeling approach is not appropriate given the secondary permeability in the formations at the Davis Canyon and Lavender Canyon sites. Therefore, a more complex modeling approach must be utilized.

Further, to identify the presence of all discrete stratigraphic continuities caused by fracturing, folding, or faulting requires a complex hydrogeologic data collection program. For example, the Leadville limestone contains near vertical solution caverns which have been observed near outcrops. Finding such structures would be very difficult using drilling. In addition, the salt repository horizon may contain anomalous zones containing inclusions of brines, pressurized gases, and petroleum products and interbeds of clastic non-salt material. Such anomalies may provide avenues for radionuclide movement or provide flow paths for salt dissolution. Therefore, it is concluded that in order to accurately assess the geohydrologic regime with reasonable certainty at these two sites, complex modeling and data collection activities will be required.

In the eleventh paragraph of this section (page 6-83), it is stated that the relative simplicity of stratigraphic, structural, and hydrogeologic features in the site vicinity makes the task of characterizing and numerically modeling the groundwater system appear to be relatively straightforward. The EA should clearly state that modeling is only "straightforward" if Darcian conditions are assumed. The state-of-the-art in numerical modeling of hydrologic systems with significant secondary porosity, including fracture and solution channels should be fully related. This will provide a perspective on the state of advancement of nonporous media models relative to porous media models.

The thirteenth paragraph (page 6-83) admits that in characterizing the geohydrologic system, the ability to do this readily may be complicated by the presence of Canyonlands NP. The EA goes on to indicate that further testing could show a need to conduct drilling activities in the park in order to resolve hydrologic issues with the site. Given the position of DOE relative to drilling within Canyonlands, we believe the need to drill in the park to properly characterize the site would also disqualify the site. This issue should be clarified and given prominence in the EA.

Page 6-84

In the analysis of the potentially adverse condition dealing with the presence of groundwater sources suitable for crop irrigation or human consumption without treatment, along groundwater flow paths from the host rock to the accessible environment, the EA indicates that the potentially adverse condition is not present. The EA notes that no groundwater sources are reported or suspected along such flow paths because of high salinity of groundwater in the Pennsylvanian formations and other older formations below the host rock. Based on the comment noted above with respect to the potential for a release scenario to the upper hydrostratigraphic unit, consideration should be given in the EA to reevaluating this finding since drinking water wells are located in Canyonlands National Park downgradient of the site in the upper hydrostratigraphic unit.

Page 6-86

"Water content of salt as less than 0.530 weight percent (Hite, 1983)." This reference was to total water (free water plus water of crystallization). It should be explained more fully.

Page 6-87

No use was made in the EA of the Bodine, M.W., and Rueger, B.F., (1984) on the clay mineralogy in GD-1, which was much more comprehensive than McCulley, and others, (1984) on this subject.

Page 6-90, Section 6.3.1.3.3 Analysis of Favorable Conditions

In the GD-1 corehole the uppermost halite of the Paradox Member is in evaporite cycle 4 where it is only 11 feet thick. The halite unit in evaporite cycle 5 is about 70 feet thick. The halite units of both of these cycles thin rapidly to the south and it is anticipated that at the Davis Canyon and Lavender Canyon sites no halite will be present in evaporite cycle 4 and it will be very thin or possibly missing in cycle 5. Thus it is possible that in the area of the two sites the uppermost salt bed will be the depository horizon (salt 6). We are concerned that the EA's do not address the fact that halite barriers to upward release of nuclides in the two sites are minimal and that this characteristic was not used in evaluating comparisons made with the other salt sites.

Page 6-92, Section 6.3.1.3.4 Analysis of Potentially Adverse Conditions

The potash mineral carnallite ($KMgCl_3.6H_2O$) contains 39 wt. percent H_2O. Through the range of -12° to 167.5° C the mineral is stable but above that temperature range the mineral begins to loose water of crystallization according to the following reaction:

$$\underset{\text{solid}}{KMgCl_3.6H_2O} \quad \underset{\text{solid}}{KCl} + \underset{\text{aquaeous}}{MgCl_2 + 6H_2O}$$

The solution resulting from this reaction is highly corrosive.

The depository horizon at Davis and Lavender Canyons is evaporite cycle 6 of the Paradox Member. The halite of this cycle contains a carnallite deposit of regional extent. This deposit was present in the GD-1 corehole and although the amount of carnallite can be expected to diminish in the direction of the potential sites it is still quite likely that some carnallite will be present. Because this deposit is in the upper half of salt 6 the depository openings will of necessity be located beneath the carnallite. The heat pulse from wastes emplaced below the carnallite deposit should be sufficient to result in melting of the mineral and generating small pockets of brine in the associated halite rock. In addition to brine formation the melting of carnallite will involve volume changes. These factors will markedly influence the stability of the salt back over the depository openings and could also bring relatively large volumes of corrosive brine into contact with the waste package. These effects have not been given adequate consideration in the EA's.

Page 6-98, Section 6.3.1.4.2 Analysis of Favorable Conditions

The 30 meters of stream incision per 100,000 years is said to "... not affect the integrity of the repository." When the total hydrologic system is better understood, the possibility should be examined that hydraulic gradients may be locally changed, for example, in near-surface groundwater system. There may be no evidence that Quaternary climatic changes brought about dissolution at the site. However, the important point is how much increased precipitation would accelerate the process of dissolution in the adjacent features.

Page 6-105

The second paragraph on this page should indicate that the majority of the Needles Fault Zone is located within Canyonlands (and therefore subject to drilling limitations).

Page 6-106, Section 6.3.1.6.4 Analysis of Disqualifying Condition

The EA cites rates of advancement of dissolution features in Texas and the WIPP Site. The EA should also provide information on the eastward migration of the grabens in the Needles Fault Zone in Canyonlands (particularly since graben formation in this area is presently active). In addition, the EA should assess the implications of dissolution features in Chesler Park and Squaw Flat - Salt Creek Pocket, both located within Canyonlands National Park. The use of dissolution rates from Texas and New Mexico in the Colorado Plateau in Utah should be supported by a comprehensive rationale for the extrapolation. Climatic histories, hydrologic systems, and geologic frameworks should be included in the comparisons.

Page 6-114, Section 6.3.1.8.1 Assumptions and Data Uncertainty

Hite (1983, page 7) has been substantively misinterpreted as declaring the potash deposits as being unmineable since they are 4,450 feet below the surface. Hite did say that a 4,000 foot economic cut off depth currently exists for shaft mining. This argument does not apply to either Davis or Lavender Canyons for the following reasons:

1) The Davis and Lavender Canyon sites are structurally higher than the site of borehole GD-1. Consequently, any potash would be at approximately 3,500 feet below the surface, well above the economic cut-off depth.

2) The 4,000 foot cut-off depth reflects current technology and economic conditions. Technological or economic changes could well lower the effective depth of mining. Only a 10-15% increase in depth is needed to make the GD-1 potash deposits (at 4,400 feet) economic.

3) Other forms of mining technology, such as solution mining could be used, not requiring permanent shaft mining.

We believe the review of these facts would conclude that the potash deposits observed in GD-1 are minable at both Davis and Lavender Canyon sites. Therefore this favorable condition does not exist.

Page 6-121, Table 6-9

The dissolution rates for the features near the site (Lockhard Basin, etc.) are not known. Extrapolation of rates from Texas may not be appropriate, as was done on page 6-106.

Page 6-138, Section 6.3.3.1.1 Statement of Qualifying Condition

The EA should indicate that the site also includes the 100-year floodplain of the unnamed tributary to Davis Canyon.

Page 6-151, Table 6-11 Items 1 and 5

The presence of carnallite in Salt 6 is known, but this was found not to be a potentially adverse condition. In contrast, the presence of brine pockets is purely speculative and yet the finding here was a potentially adverse condition is present. This does not seem consistent.

Page 6-185, Other Sources of Water

It is indicated in the EA that interbeds in the salt may have a significant transmissivity and provide a potential conduit for groundwater. The significance of these beds could be considerable and should be given emphasis in the future studies mentioned. The lateral extent of such interbeds is especially important.

Page 6-185

Figure 46 of Hite (1983) showed bound water not free water. In Salt 6 in GD-1, carnallite free samples of halite rock contained 0.078 to 0.126 weight percent water.

Page 6-210, Possible Darcy Flow in Host Rock

It is not apparent that the methodology for computing groundwater travel times in the host rock presented in Section 6.4.2.3.5 results in significantly longer groundwater travel times than those discussed in Section 3.3.2.1 if the higher rate at Section 6.4.2.3.5 is compared to that of Section 3.3.2.1 and uncertainties are considered.

Page 6-211, Aquifer Groundwater Flow

In the first paragraph, groundwater travel times are again inappropriately calculated at the "regulatory accessible environment" (i.e., at 10 kilometers). Total groundwater travel time to the accessible environment is calculated to be about 123,000 to 153,000 years. These calculated groundwater travel times are different than those presented previously in the EA.

In the third paragraph (pages 6-211 - 212) INTERA evaluated various changes in the hydrologic regime of the Gibson Dome area as a result of various tectonic, climatic, and geomorphic perturbations. From information presented in the EA, these analyses continue to assume Darcian flow conditions with only primary porosity considered and generally evaluate only changes in head. For example, secondary permeability and the formation of breccia pipes are not

considered. Therefore, the perturbations evaluated by INTERA should not be considered comprehensive (nor "worst case").

Page 6-218, Table 6-34

This table indicates that the maximum 10,000 year travel distance is 50 meters from the disturbed zone (or a total of 60 meters from the repository assuming 10 meters for the disturbed zone). The table should describe how this groundwater travel distance was calculated.

Page 6-221, Human Interference

In the second full paragraph on this page, it would be informative to the reader to briefly describe the groundwater transport scenarios of Pepping et al (1983) where the radionuclide release limits of the EPA standards were exceeded.

Chapter 7 Comparative Evaluation of Sites Proposed for Nomination

Page 7-3, Section 7.1.2 Approach and Organization

The third paragraph of this section states that where data were insufficient for a conclusive evaluation of the guidelines, a generally conservative position was taken. In regard to the estimation of groundwater travel times, a less than conservative position was taken (as noted in comments given above).

Page 7-11, Geohydrology

In the first full paragraph discussion of groundwater travel time estimates for the Deaf Smith and Davis Canyon sites, the EA states that flows through units underlying the host rock were estimated "taking into account the secondary openings." This approach was not used in the evaluation of groundwater travel times at the Davis Canyon site. (Only primary porosity was considered.)

Page 7-27

Surely the presence of carnallite, organic matter, and hydrocarbons at Davis Canyon and their absence at Deaf Smith would change these rankings.

Page 7-52, Natural Resources

The third paragraph states that the Davis Canyon site has only minor aquifers above the host rock, and the water is of low quality. It should be noted that the Cedar Mesa Sandstone aquifer above the host rock is used as a water supply for Canyonlands.

Page 7-54, Post-Closure Guidelines

In regard to groundwater travel times, lines 6-8 on this page state that "the conservatism of the analyses are believed sufficient to compensate for the large uncertainties in the site data." As noted previously, the approach to groundwater modeling in the EA is not "conservative."

Page 7-61, Section 7.3.1.1.2 Site Ownership and Control

See our comments on section 2.2.3.

Page 7-84, Socioeconomics/Water Use

In the first full paragraph on this page, discussing potentially adverse conditions for socioeconomics, it is stated that "at Davis Canyon, water requirements are also not expected to adversely affect future development; however, this judgment is preliminary, as there is some uncertainty about potential short-term disruption of the area water supply during repository construction at this site." This statement should be clarified; does this statement imply disruption of groundwater at the site?

Page 7-93, Potentially Adverse Conditions for Transportation

The EA identifies terrain along the access routes to the Davis Canyon site (particularly along the Colorado River) that might lead to hazardous conditions. Based on this concert, the EA should assess the implication of an accidental radionuclide release to the Colorado River in the vicinity of the Gibson Dome sites. In addition, neither Chapter 7 nor Appendix A of the EA discuss the overall relative risk of the various repository sites to regional water resources (e.g., the relative risks associated with (a) a radionuclide release to the Colorado River from the proposed sites at Gibson Dome and resultant effects on downstream municipal, domestic, irrigation, electric power, and recreational uses; (b) a radionuclide release to the regionally-important Ogallala Aquifer from the proposed repository sites in Texas; and (c) radionuclide releases at the other proposed sites in regional water resources).

The following references were provided to DOE earlier. They should be included among the EA References:

Davidson-Peterson Associates, Inc. 1978. Visitor use study, selected Utah parks; Analytical report; Volume I. Prepared for the National Park Service.

Foch, James D. Jr., and Geoff S. Oliver. 1980. Technical report on sound levels in Bryce Canyon National Park and the noise impact of the proposed Alton coal mine. Noise Technical Assistance Center, University of Colorado, Boulder, Colorado, 80309.

Harrison, Robin T., Roger N. Clark, and George H. Stankey. 1980. Predicting impact of noise on recreationists. Forest Service--U.S. Department Of Agriculture, Equipment Development Center, San Dimas, California, 91773.

Ross, David M., Glenn E. Haas, and Ross J. Loomis. 1985. Assessment of visibility impairment on visitor enjoyment and utilization of park resources (executive summary). Colorado State University, Ft. Collins, Colorado. Submitted to Air Quality Division, National Park Service.

USDI. NPS. 1985. Huntoon, Peter W. Geohydrologic and Tectonic Evaluation of the Proposed Davis Canyon High Level Nuclear Waste Repository, Paradox Basin, Southeastern Utah.

USDI. NPS. 1984. Griffin, Dennis P. Archeological Inventory Survey, Salt Creek Archeological District: Areas Adjacent to the Nuclear Waste Repository Study Site. Excerpt. 432 pp. Lincoln.

United States Statutes. 78 Stat. 934

United States Congress. Senate Report No. 381, 88th Congress, 1st Session.

United States Congress. House Report No. 1823, 88th Congress, 2nd Session.

United States Code. Title 16. Section 1a-1.

Page	Section	Comment
7	3	Change Blanding to Monticello.
8	Fig. 2	Highway 211 extends into the National Park.
9	Para. 2	The reference to Figure 3 is a poor reference. The Figure does not show the relationship of Davis Canyon to the Paradox Basin as stated, rather it shows the stratigraphy of the area.
9	Para. 4	Davis Canyon is an ephemeral wash, not intermittent, as mentioned elsewhere in the text, e.g., 3-115, 3-132.
9	Para. 4	In this paragraph/salinity is differentiated from total dissolved solids. The final statement should explain the rationale if they are different.
9	Para. 4	We do not agree with the 400-percent increase in water use is not possible. All the available water for large irrigation projects, industry, and municipal use has already been appropriated and almost fully developed. Water use in the future will have to operate within existing appropriation except for small household and stockwater uses.
10	Fig. 3	The figure should footnote in which salt cycle the repository is proposed to be built.
13	Para. 1	"...of 6 about acres." Should read: ...of about 6 acres.
14	Para. 1	There is no way a population increase due to construction or operation will place a housing burden on Blanding. It is too far away from the site.
14	Para. 2	...about 400 metric tons of uranium...to a max of 3000 metric tons of uranium. We question whether it should read nuclear waste rather than uranium.
19	6.3.1 Para. 2	The closest highly populated areas are Moab, 33 miles...and Blanding, 35 miles away... Change Blanding to Monticello, 35 miles away...
1-2	Para. 2	"...perhaps specially designed backfill material to separate the waste canister from the host rock." This makes it sound as though the necessary measures needed to impede ground water circulation are not exactly known.

2-2	Fig. 2-1	In the upper right corner of map Delores River should read Dolores River.
2-15		Guideline "Human Interference" identified twelve deep boreholes that penetrate through the repository salt horizon within 10 km of the site. It is unclear how impacts from these holes will be mitigated.
3-1	3.1 Para. 4	...adjacent to Six-Shooter Peak...Should read... adjacent to South Six-Shooter Peak.
3-131	Para. 8	The proper units or expression for permeability should be used.
3-131	Para. 8	"The most widespread and transmissive formation is the Mississippi Leadville Limestone: seems to conflict with "The lower hydrostratigraphic unit is capable of producing saline water" on page 3-146 Paragraph 1 which again conflicts with Paragraph 3, Page 333 which says "Substantial quantities of ground water exist in the deeper portion...and in the Leadville Limestone."
3-146	Para. 7	The reference to Figure 2-1 is in error - it is a location map. Figure 3-41 is a land ownership map and would be the proper reference.
3-147	Para. 4	In the statement on acreage (5920 acres) it should be noted that these are BLM acres only. Other acreage accessible to cattle include 110 acres owned by the State and 430 acres in private ownership.
3-152	Para. 3	"...views of Redrock Canyonlands..." redrock should not be capitalized.
3-152	Para. 4	1,010 acres should be 1,040.
3-153	Para. 6	"...and riparian hardwood communities." There are no riparian hardwood communities in the area.
3-154	Para. 1&7	..pinyon-pine-juniper... Should read: pinyon pine-juniper...
3-154	Para. 7	Need to capitalize South and North Six-Shooter Peaks.
3-158	Para. 3	...that 10 to 15 deer overwinter in Davis Canyon...Is not correct. However, it is true for Lavender Canyon.

3-159	Para. 1	The reference to (tables 3-19 & 3-21) is not correct. Should read (Tables 3-19 and 3-20).
3-159	Para. 3	..Two Federally listed endangered plant species... This is not correct. Echinocereus englemanii var purpureus occurs only in Washington County on the western side of the State.
3-160	Table 3-19	The above-mentioned specie needs to be removed from the table as occurring in San Juan County.
3-169	Para. 2	This paragraph discusses about flooding in Lavender Canyon. It should state Davis Canyon.
3-170	Para. 5	The definition of the different VRM classes (in terms of the amount of acceptible levels of visual change) should be included as baseline information from which impacts are analyzed.
3-170	Para. 6	A map showing the VRM classes for the area would be beneficial. The area should include: 1) the repository site; 2) the proposed railroad corridor; and 3) the utility corridor. This would provide the baseline VRM classes from which impacts are measured.
3-177	3.4.7	Table 3-22 does not represent the Four Corners area. The background radiation level in the Four Corners area is higher than anywhere else in the State due to the geology of the area.
3-179	Para. 4	The monument is located on the north, the proposed park is on the north and south. The proposal for a park has been denied by BLM.
3-181	Para. 1	The airport is owned by Cortez City and Montezuma County. There is no Cortez County.
3-186	Para. 4	The office of the Utah State Planning Coordinator has been updating its baseline projections annually. The text should state what year these projections were based upon. It is unclear whether they account for the 5 percent population decrease experienced in Grand County between 1981 and 1983.
3-195	Para. 3	Local expenditures are highly related to length of stay. If someone remains for an extra day visiting a non-destination point should be attributed to that non destination attraction. The procedure used, which ignores visitation to non-destination attractions, overestimates the local importance of destination visits to Canyonlands NP and underestimates the local

		importance of non-destination visits to Canyonlands NP.
3-196	Para. 7	Excess community service capacity has changed significantly since 1981 and should somehow be reflected in the discussion. The section on housing in particular should note that housing unit vacancy rates have changed significantly since 1980.
3-204	Para. 3	There is little or no discussion on how well each community's social organization can respond to the projected growth. Although the impact section identifies several social factors which affect a community's ability to accommodate growth there is little analysis of these factors as they relate to each community. Also, the discussion should assess each community's attitudes towards growth and development, local lifestyle values and other indicators of well being.
4-1	Para.2	"...and grazing rights..." should be changed to "...and grazing privileges..."
4-5 4-6	Tables 4-2 Figure 4-1	It would make review easier if the order of display for the activities on Table 4-2 were identical to those in Figure 4-1.
4-9	Para. 11	... (total max. work force at any one time is 15) Table 4-2 says 24 max.
4-11	Location/ Access	... (SC) boreholes are shown on Figures 4-3 and 4-4...These boreholes are not shown on Figure 4-4.
4-13	Figure 4	Legend shows LC as a symbol. There is no corresponding symbol on the Figure.
4-69	4-1.3.1.3	There is no time frame for constructing the ionology tower; the number days and workers are omitted, etc. This activity should be treated similarly to other activities.
4-79	Para. 2	There are no wild roaming horses or burros on the site.
4-79	Para. 1	"The estimated 10 to 15 overwintering mule deer in Davis Canyon..." This statement is only true for Lavender Canyon. At most there are probably only 2 to 3 overwintering deer in Davis Canyon.

4-88	Para. 7	We have found that Utah State policy will not allow exceedances of Class I TSP allowable increments even from temporary sources.
4-94	Table	Utah State policy will not allow 24-hour TSP concentrations in excess of the 10 microgram per cubic meter limit even for temporary sources.
4-107	Davis Canyon	Contrast ratings (both short and long term examples of each) should be completed for: 7) MT - 3 8) MT - 4 9) SG - 2 10) Railroad Route 11) Repository 12) Access Road 13) Utilities 14) Other Miscellaneous activities (e.g., trenches, etc.) Several ratings may be required for each drillsite, road, rail route, etc.
4-103	4.2.1.7 Lavender Canyon	Contrast ratings (both short and long term examples of each) should be completed for: 1) LC - 2 2) LC - 3 3) LC - 4 4) LC - 5 5) MT - 1 6) MT - 4 7) MT - 3 8) SG - 2 9) Repository 10) Railroad Route 11) Access Road 12) Utilities 13) Other miscellaneous activities (e.g., trenches) Several ratings may be required for each drillsite, road, rail route, etc.
4-109	4.2.1.8 Para. 2	The DOE has made no attempt to formally comply with Section 106 of the National Historic Preservation Act. Determinations of eligibility for affected cultural properties from the National Register staff and a determination of effect from the Advisory Council still need to be obtained by the DOE through consultation with the BLM and Utah SHPO. Formal consultation should be completed prior to issuance of a final EA.

4-109	4.2.1.8 Para. 3	In order to comply with the American Indian Religious Freedom Act and Archeological Resource Protection Act formal consultation with Native Americans should already have been initiated.
4-113 4-114		Until such time as DOE formally complies with Section 106 of the National Historic Preservation Act, statements concerning mitigation of potential direct and indirect impacts resulting from the exploratory shaft facility, lower hydrostratigraphic unit test wells, near-shaft hydrostratigraphic drill sites, hydrologic-geologic boreholes, Shay Graben test trench, stratigraphic confirmation boreholes, seismic lines, and seismic network stations remain premature.
4-123	Para. 3	Temporary activities, according to Utah State Policy, are those that last less than 180 days.
4-131	Para. 1	The basis for the statement on vacancy rates should reflect the existing situation. Even based on 1980 data, there are sufficient vacant housing units and vacant mobile home spaces between Grand County and San Juan County to accommodate the projected immigration. Although the housing supply in Monticello and Blanding may be inadequate based upon the population allocation model, in the short run people will settle where there is available housing, which the Moab area would apparently have.
4-131	Para. 4	If additional governmental revenues are discussed then additional governmental cost should also be discussed. Would Grand County be eligible for grants in lieu of taxes?
5-44	Para. 1	Acreages (5760 and 5920) are BLM only. Total acreage accessible to cattle is as follows: 5920 acres BLM 110 acres State 430 Private 6460 acres Total
5-45	Para. 16	The U.S. Bureau of Land Management (BLM) estimates that 10 to 25 mule deer presently utilize Davis Canyon for overwintering habitat, with one or two deer possibly residing all year. (Sandberg & McClure, 1983.)

5-115	Para. 8	Unemployment rates have not increased significantly between 1960 and 1980 but have increased significantly since 1981.
5-121	Para. 5	Increased local expenditures can be attributed to any recreation attraction which keeps visitors in the area longer. Therefore, some tourist expenditures may be related to Dead Horse State Park, Newspaper Rock and BLM overlooks.
5-122	Para. 6 & Table 5-25	The requirements for the added school room, new schools, etc., should be described.
5-127	Para. 2	A reference for the native population/total population ratios is needed.