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**Date:** 07/18/2006 2:06:53 PM  
**Subject:** Comment Responses to April 4 and 5 meeting Moab RAP - WM-110

Mike,

As we discussed, Attached are proposed Comment Responses from the April 4 and 5 meetings. The August 31 Draft RAP submittal will be revised according to the Attachment. Please have you reviewers take a look and let me know if there are any areas of concern.

Thanks,

Joel <<RNRCCommResp.doc>>

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## Moab UMTRA Project

### Response to NRC comments made at the April 4 and 5, 2006, meeting on discussion of Draft Moab Remedial Action Plan

#### GEOLOGY

1 (a) "Linear feature - explain further why the stratigraphy of the Prairie Canyon Member defines the lineament..." It is asserted that the lineament is stratigraphically controlled, i.e., there is little direct technical support provided in the RAP that an informed reviewer could rely on to concur. The nature of the contact of the two members of Mancos Shale that are adjacent to or directly underlie the footprint take on importance for understanding present and future site conditions and the behavior of surface and groundwater that flows across and through the contact zone. If the contact is stratigraphic, explain why is it not linear everywhere it is exposed. If the lineament cannot be explained definitively as stratigraphic, then it may be structural, such as a fault contact. Such a possibility would entail investigating whether or not it is a capable fault.

Response: The line of dolomitic concretions that mark the top of the Prairie Canyon Member in the site area will be traversed for 3 miles through the withdrawal area (Sections 22 through 24), and evidence will be sought for any offset in this line of outcrop. The Surficial and Bedrock Geology calculation set will be revised to include results of the outcrop traverse or the results will be incorporated into the RAS, as appropriate. Also included either in the calculation set revision or the RAS, will be additional references and narrative that support the stratigraphic horizon explanation for the expressed linear feature.

1 (b) "...and that the linear feature is not offset by faults." The applicant's idea of explaining why the linear feature is not offset by faults (and the significance of such an observation ) is potentially useful for showing structural integrity of the lineament only where it is exposed to scrutiny.

Response: If any displacement of the line of dolomitic concretions is suspected during the traverse, two or more sites will be proposed where a trench could be dug at a right angle to the linear feature to provide better exposure and confirm displacement. The Surficial and Bedrock Geology calculation set will be revised to include results of any confirmed or suspected displacement of the linear feature or the results will be incorporated into the RAS, as appropriate.

(2) "Provide photo(s) from the top of the Book Cliffs showing the lineament." [does not affect RAP]. This request was made to enable the NRC staff to inspect the lineament more clearly or enlarged than from the copy in the draft RAP.

Response: Four photos taken on July 19, 2005, from the top of the Book Cliffs just north of the site showing the subject lineament will be sent to the NRC for their inspection. [These photos were sent to the NRC on May 3, 2006.]

(3) "Linear feature - evaluate any geophysical reflection data on fracture orientations in boreholes (005 and 023) and corehole (0201) north of the lineament." The objective of

such investigations appears to be to obtain data on the characteristics of the contact zone and to seek evidence for the origin of the lineament. Such data may be potentially useful for assessing the geomechanical properties of the rocks, flow and transport properties and conceptual models of the rocks at and near the site.

Response: Geophysical seismic reflection survey data on fracture orientations will be evaluated for corehole 0201, which is just north of the lineament. If any significant characteristics of the contact zone or of the lineament are identified, they will be included either as a revision to the Surficial and Bedrock Geology calculation set or will be incorporated into the RAS, as appropriate.

(4) "Low sun-angle photos - send a copy to NRC for inspection." [does not affect RAP]. The request was made because the photos were identified, but not provided in the draft RAP.

Response: A set of low sun-angle photographs taken on July 27, 2005, will be sent to the NRC for their inspection. [These photographs were sent to the NRC on May 3, 2006.]

(5) "Document/evaluate rates of changes of surface geologic processes such as (a) scarp retreat of the Book Cliffs, (b) rock falls and roll distances (petroglyph dates),..." These geomorphic processes result in (i) erosion of the cliffs that dominate the site by gravity, running water and wind, (ii) the transport of rock particles of all sizes up to large boulders, and (iii) the deposition of the rock particles. The smaller particles, sizes up to small boulders, are shown on photos and reported to have been transported to (and impinge upon) the proposed footprint and beyond (lower elevations), largely by sheetwash. There is a need to quantify or otherwise bound the sediment loading of the surface drainage system for the next 200 to 1000 years as input to the design of the empoundment to achieve the necessary performance.

Response: Average scarp retreat rates will be cited to quantify the northward retreat of the Book Cliffs, and archeologist-estimated dates of petroglyphs on boulders at the base of the Book Cliffs will be cited as evidence for minimum age of rock falls. The Site and Regional Geomorphology – Results of Site Investigations calculation set will be revised to include the above data and interpretations or these data will be incorporated into the RAS, as appropriate.

(5) (c) "...and rate of incision (headcutting) migration of West Kendall and Crescent Washes." In fact, the potential hazard to the proposed empoundment from any stream, wash or gully that may erode headward and intersect or otherwise affect the empoundment in the next 200 to 1000 years needs to be fully investigated and evaluated as potential inputs to design for mitigation.

Response: Earliest available aerial photographs (1944) of the site will be acquired, registered, and compared to recent photographs to determine the distance of headcut migration in the West Branch of Kendall Wash drainage; changes in channel incision will also be compared in Crescent Wash. This distance of incision over approximately 60 years will give an estimate of the rate of incision, which will be included either in a revision to the Site and Regional Geomorphology – Results of Site Investigations calculation set or incorporated into the RAS, as appropriate.

(6) (a) "Evaluate the effect (if any) of fractures on weathered Mancos Shale and on hydrology." Because fractures exist at the site and beyond (from observations of pits, core and outcrops) in weathered (and unweathered) Mancos Shale, characteristics of fractures in both the Prairie Canyon and Blue Gate Members should be investigated only to the level of detail commensurate with their significance to design and to performance evaluations.

Response: Corehole lithologic logs will be examined to determine if there is any difference in characteristics of fractures in the weathered Prairie Canyon and Blue Gate Members of the Mancos Shale. No ground water was found during drilling of any of the coreholes. Ground water later entered some of the coreholes, but the pathways of ground water entry to these coreholes appears to be much deeper than the depth of fracturing as seen in downhole camera footage. The Surficial and Bedrock Geology calculation set will be revised to include results of fracture characteristics for the weathered Prairie Canyon and Blue Gate Members or the results will be incorporated into the RAS, as appropriate.

(6) (b) Suggest DOE prepare explicit characteristics of "weathered" and "unweathered" Members of the Mancos Shale, given that these are end members of a gradational series. The goal is to minimize ambiguous data from samples that are partially weathered or partially unweathered. Implicit in the description of the characteristics of the weathered Mancos Shale, such as fractures, is the need to describe the characteristics that distinguish the weathered Mancos Shale from the bedrock Mancos Shale (for both the Prairie Canyon and Blue Gate Members). DOE stated at the meeting that the weathered zone of the Mancos grades gradually into the unweathered (bedrock) Mancos, making it necessary to describe criteria to distinguish each type of shale.

Response: Characteristics of weathered and unweathered Mancos Shale bedrock for both the Prairie Canyon and Blue Gate Members will be included either in a revised Surficial and Bedrock Geology calculation set or the results will be incorporated into the RAS, as appropriate.

(7) "Evaluate more fully the reason(s) for the abandonment of the course of the ancestral East Branch of Kendall Wash and assess if future drainage abandonments could occur and their affect on the site." The significance of a stream abandonment on a bajada or pediment for understanding future stability or predictability of drainage networks depends on the cause(s), rates of reestablishment of the drainage change, and future site conditions. The observation of large boulders in a wash in or near the abandoned system unusually far from the Book Cliffs suggests the possibility that a highly energetic, but localized, wash may occur again in a situation similar to that of the proposed footprint.

Response: Additional characterization of the features of the ancestral East Branch will be conducted to investigate probable reason(s) for abandonment of this high-energy drainage and the probability that this type of drainage abandonment could occur in the immediate area of the proposed disposal cell. The Photogeologic Interpretation calculation set will be revised to include results of the ancestral East Branch investigation or the results will be incorporated into the RAS, as appropriate.

(8) "Erosion surfaces appear to be displaced from aerial photos - determine if they are displaced and their significance if they show Quaternary movement." Because displaced

erosion surfaces may have been caused by neotectonic activity, they are potential clues to seismic sources. They may be also caused by aseismic structural deformation. Such potential surfaces were reported in RAP Attachment 2, Appendix G, Plate 1 and captions 'g' and 'h' for Low Sun Angle photograph.

Response: The reason(s) for the apparent displacement of the erosion surfaces in the two areas will be determined. The Photogeologic Interpretation calculation set will be revised to include the results of investigation of these two areas or the results will be incorporated into the RAS, as appropriate. If displacement is determined to be related to Quaternary movement along faults, then the calculation set on Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration will be revised to include the seismic effects.

(9) "Expand the discussion on potential natural resources (oil/gas, salt/potash, uranium/vanadium, and gold) based on current economics." An update is prudent, given that gold is near its all time high and oil is at its all time high, for example.

Response: Additional discussion on potential natural resources in the site area will be included in the Resource Development section of the revised calculation set on Site and Regional Geology – Results of Literature Research or the results will be incorporated into the RAS, as appropriate.

(10) "If oil/gas resources are present below the site, and these were exploited, could subsidence (and how much?) occur?" .

Response: A brief discussion of the possibility for subsidence at the site if extraction of deep oil and gas resources were to occur will be included in the Geologic Hazards section of the revised calculation set on Site and Regional Geology – Results of Literature Research or the results will be incorporated into the RAS, as appropriate.

(11) "Further document the past occurrence of shallow gas in the Mancos Shale and its potential to occur at the site." Given that DOE reported evidence of natural gas in at least one of its boreholes on or near the site, that gas blowout preventers have been used by local drillers because of a known (little evidence presented) or presumed hazard, it is prudent to investigate the history, likelihood, expected magnitude of such a hazard at the site or at analogous sites in the area.

Response: Information on shallow gas that was encountered in Mancos Shale during the 1920s drilling of oil test wells in the site area will be added to the section on Geologic Hazards in the revised calculation set on Site and Regional Geology – Results of Literature Research or the results will be incorporated into the RAS, as appropriate.

(12) From Disposal Cell Section: "The sheet flow process described in the geology section is expected to continue after cell construction and must be considered in the design." From a geological review perspective, the description of the sheet flow hazard (in the Geology Section) would need a technical basis to support an estimation of locations, rates and magnitudes of water and mass movements over the next 200 to 1000 years.

Response: Information obtained from the Response to 5 (a and b) above will be used to estimate the rate of future accumulation of sheetflow deposits. These results will be

included in the revision to the Surficial and Bedrock Geology calculation set or will be incorporated into the RAS, as appropriate.

## SEISMOLOGY

(13) "Indicate which faults are capable/not capable and basis for assumption." Identify the known and suspected faults in the area such that if any were of such size and distance from the site that, if seismogenic, would affect the site and need to be evaluated for its seismic loading potential.

Response: Additional information to support classification of faults as capable or not capable will be included in the Quaternary Faults section in the revised calculation set on Site and Regional Seismicity – Results of Literature Research.

(14) Provide rationale for using 6.2 for the floating earthquake when 5.9 is listed as the maximum earthquake on p. 6.

Response: Will explain in the text in Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration the difference between the estimation of the maximum predicted earthquake and the maximum historically recorded event.

(15) Indicate why some faults included in the calculations for the Cheney site were not included for the Crescent Junction site.

Response: Will explain in the text in Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration that although the Cheney site is used as a comparison for a site within the same tectonic province, the sites are not in the same location, so faults located closer to one site will have the potential of having larger impacts on the close site as compared to the farther site. Specific faults can be address on an individual basis for the faults that are relevant to both sites.

(16) Provide velocity data from geophysics for the rippability study for the weathered and unweathered Mancos Shale below the site.

Response: The geophysical investigation at the Crescent Junction site was done specifically to access rippability of the Mancos Shale during construction of the disposal cell. As such, the investigation consisted of determining the seismic velocities of the weathered and unweathered shale deposits using compression wave data. Shear wave velocities and shear modulus are typically the parameters used to evaluate the stiffness of the foundational materials to evaluate if amplification of ground motions would be expected. However, on a qualitative basis, the seismic velocity data will be presented to support the claim that site amplifications will be negligible.

(17) Provide more justification to support the salt dissolution origin for the Thompson Anticline and Tenmile Graben structures.

Response: Further documentation will be presented in the discussion of Quaternary Faults in Site and Regional Seismicity – Results of Literature Research.

(18) Determine if Granite Creek and Ryan Creek Faults on the Uncompahgre Uplift are connected and what acceleration would result.

Response: Mapping of these faults will be checked to determine if evidence supports possibility of the two faults being connected. If it is reasonable to assume the two faults are connected, this assumption will be considered in determining what acceleration could be generated from the structure.

(19) In Appendix B Table, change the Wells and Coppersmith rupture-length reference to Campbell.

Response: The Appendices will be adjusted to make column headings more clear.

(20) Provide latitude and longitude for fault systems in tables.

Response: Latitudes and longitudes will be shown on all figures. Tables will be evaluated to see what information can be provided to make faults and earthquake events identifiable on the figures.

(21) Provide copy of Cheney RAP.

Response: A copy of the Cheney RAP will be provided. [The Cheney RAP was sent to the NRC on May 3, 2006.]

(22) Provide justification for using 0.42 g for Cheney design while 0.21 g for Crescent Junction.

Response: Specific text will be incorporated into the results of Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration to explain the different influences on seismicity at each site.

(23) Address amplification when estimating the seismic design for the site.

Response: The text will be added to Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration to specifically address amplification at the site.

(24) Provide any available reflection or geophysical data which may shed light on the stratigraphy and seismic velocity at the site.

Response: Seismic velocity data from the rippability study will be provided.

(25) Make sure the earthquake distributions in Fig. 4 App. (E) are consistent with those in Fig. 1 App. (F).

Response: The number of significant figures used to describe the latitude and longitude of earthquakes was dropped by one digit in Figure 1 of Site and Regional Seismicity – Results of Maximum Credible Earthquake Estimation and Peak Horizontal Acceleration (App. E), causing the location of some events to shift slightly. In addition, text will address why some events presented in App. E (Lit Review) are not considered in App. F (MCE and PHA).



(26) Identify the different symbols in App. (E/B) and App. (F/A).

Response: The column headings in these appendices will be modified to be more understandable.

(27) Address if liquefaction may occur at the site.

Response: A discussion of this evaluation will be in a separate calculation set.