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22 Oct 96

Joseph J. Holonich, Chief
Chief, High-Level Waste and Uranium Recovery Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
Mail Stop TWFN 7J-9
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Evaluation of Potential Surface Deformation Related to Salt-Dissolution Subsidence at the Atlas Tailings Site, Moab, UT, 8 Jul 96, Woodward-Clyde Federal Services.

Dear Mr. Holonich:

I was recently able to obtain a copy of the above report. In reviewing it I feel that the deformation analysis using the simplified approach of Bray *et al.* is not adequate for the complexities of the Atlas site for the following reasons.

1.) Bray himself states that, "The phenomenon of earthquake rupture propagation through soil is quite complex and is not well understood at this time." Bray then concludes, "Of course, given the complexity of fault rupture propagation, the results of this study must be applied with the use of good engineering judgment. Further study regarding the reliability of these analytical procedures would be useful to investigate aspects of the problem not addressed in this study." Bray's analyses are not established fact as alluded to by the above report, they are relatively recent studies with considerable variability and uncertainty.

2.) Aspects of the problem not addressed in the above study which are present at the Atlas site are as follows:
a.) The Bray analysis described is for modeling fault rupture propagation through clays, not alluvium and tailings.
b.) The tailings pile nonlineal stress-strain behavior was not adequately modeled. Averaging 17 samples is not characteristic of the Atlas tailings site. The range for course tailings is 3.35 to 19.47 among 7 bore holes. Triaxial compression tests are not

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representative for the Atlas site because of the unconstrained free face of the the tailings pile with minimal lateral confining forces. (see attached figure A) The Bray model would be more applicable to subgrade disposal.

c.) The error bars from the Bray model were not used, only the medium.

d.) The conclusion that the area of potential maximum subsidence most likely does not extend beneath the tailing cap is contraindicated by figure 4, section B-B' of the report.

e.) The angle of dip of the fault plane is important to the corresponding area of surface displacement. What is the angle of dip of the fault plane at the Atlas site? (see Bray fig.7)

f.) Inclusion of the alluvium in the total thickness of the overburden calculations does not take into account the preferential plane of weakness developed through the alluvium and probably present at or near the surface.

In conclusion, even though I question the unqualified absolute use of Bray's Finite Element Prediction model for this specific site; when one looks at the data presented, there are predictable ruptures in the 2 faces of the tailings pile where the pile intersects the plane of the buried escarpment. This does not support the report's final conclusion that the potential for differential offsets reaching the surface of the pile as a result of salt dissolution over the next 1000 years is negligible.

Boring B-14 list three samples with Strain(%) of 4.12, 5.83 and 7.18, with an average of 5.7. Using Bray's model the corresponding height of rupture zone would be 17 +/- 2 times the offset, which would be 15-19 meters and 30-38 meters for offsets of 1 and 2 meters, respectively. As the boring is less than 15 meters above the surface, rupture would occur near this boring with less than 1 meter offset within the 1000 year time frame. 1 meter of offset is also less than the 1.33 meter/1000 years offset Grand County has observed with the Northwest Pipeline data previously submitted. It is important to note that B-14 is very likely on the fault plane as evidenced by figure 4, section B-B'. Also the use of triaxial compression tests from this boring is not representative due to the free face and the lack of lateral confining forces, the actual strain(%) number is undoubtedly less and thus rupture would occur sooner. How much further up through the face and perhaps top of the pile might the rupture propagate once it has breached the slopes of the pile?

Boring B-13 list two samples with Strain (%) of 13 and 15 , with an average of 14. the corresponding height of rupture zone would 8 +/- 2 times the offset, which would be 6-10 meters and 12 to 20 meters for offsets of 1 and 2 meters, respectively. Given that the height of B-13 is roughly 32 meters then it could take as long as 4000 years and as short as 2000 years before the rupture reaches the top surface of the pile. Again it is important to note that B-13 is very likely near the fault plane as evidenced by figure 4, section B-B'. The use of triaxial compression tests from this boring is probably not representative again due to the free face of the pile and minimum of lateral confining forces, the actual Strain(%) number would be less and thus rupture would occur sooner. Despite the fact that rupture may not occur within the 1000 year time frame at the B-13 boring, (depending also on how fast the ruptures that will definitely occur propagate on both slopes of the tailings pile that intersect the buried escarpment plane of offset), isn't there something in the regulations that state that a proposal requiring active maintenance is not

a permitted alternative? At the very least, shouldn't these absolutely predictable maintenence costs be assessed and compared in the final fiscal analysis of the two alternatives?

What happens once the surface has been breached? Doesn't it then slip against the remaining pile at a rate close to the subsidence rate for eternity? Eventually, what would prevent this quarter of the pile from ending up in the Colorado River in 10-20,000 years?

Meanwhile what happens to the tailings pile erosion protection as the rock apron designed to protect the pile from the forces of the Colorado River is also sinking from 1-2 meters/1000 years? As the base of the pile is 2 meters above the average river flow of 4200 cfs, what happens in 1000 to 2000 years when the river begins flowing against the pile on a daily basis and freezing against the pile each winter? This is assuming that the rock apron performs as designed, which I feel is doubtful. The entire bank on the tailings side of the river has exposed tamarisks roots, indicating erosionon an annual basis. Yet there are large areas of bank aggradation on the opposite side of the river.

Thank you for the opportunity to comment on this additional report that was issued after the draft TER was issued.

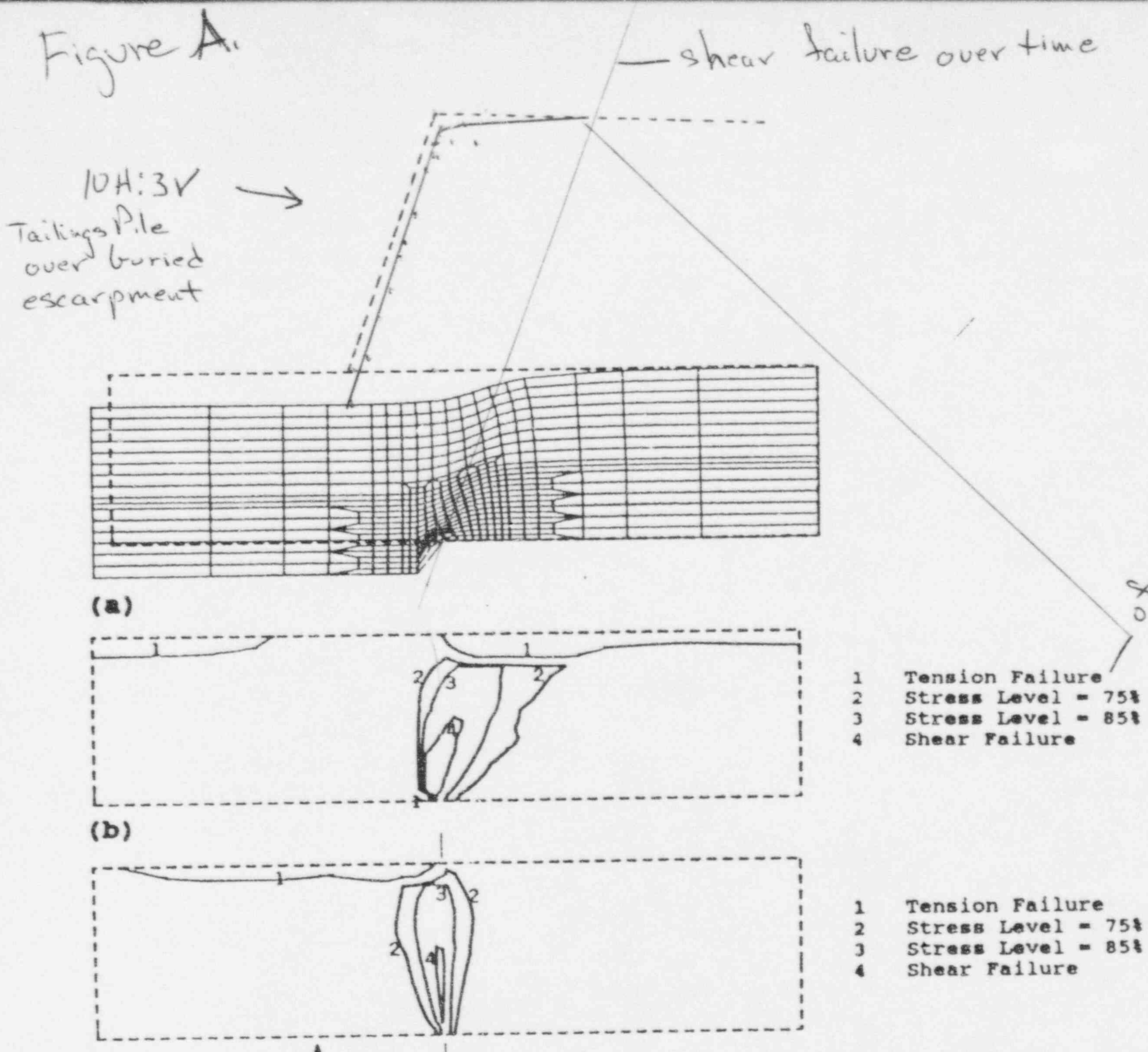
Sincerely,

Peter Haney

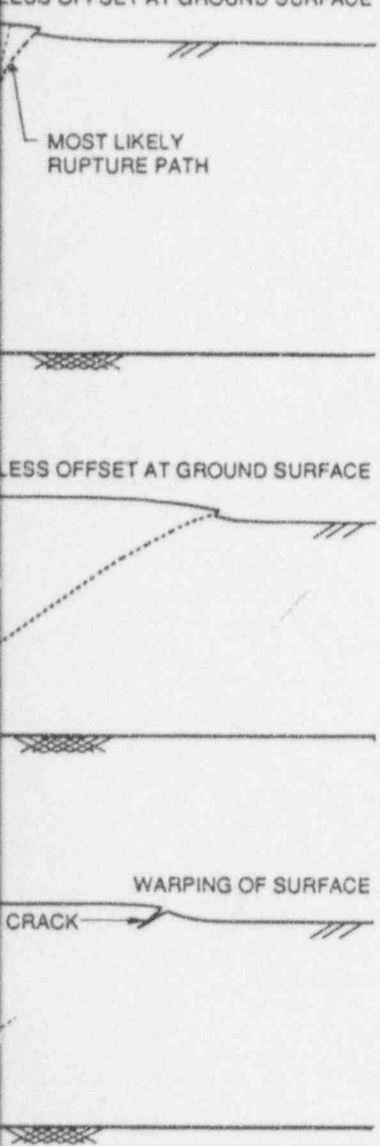
cc: w/enclosures

Senator Hatch
Senator Bennett
Congressman Orton
Congresswoman Greene
Governor Leavitt
Phil Justice
Ted Johnson
Woodward-Clyde Federal Services

Figure A.



p.576 Bray et al. J. Geotech. Engrg., ASCE 120(3) 562-580.



ough Soil: (*a*) Stiff Earth Materials, Steep
(*c*) Ductile Earth Materials

gnificant fault movement by warping
ear surfaces.
rential movement across a fault zone
break so that the problem is likely
he remainder of the movement can

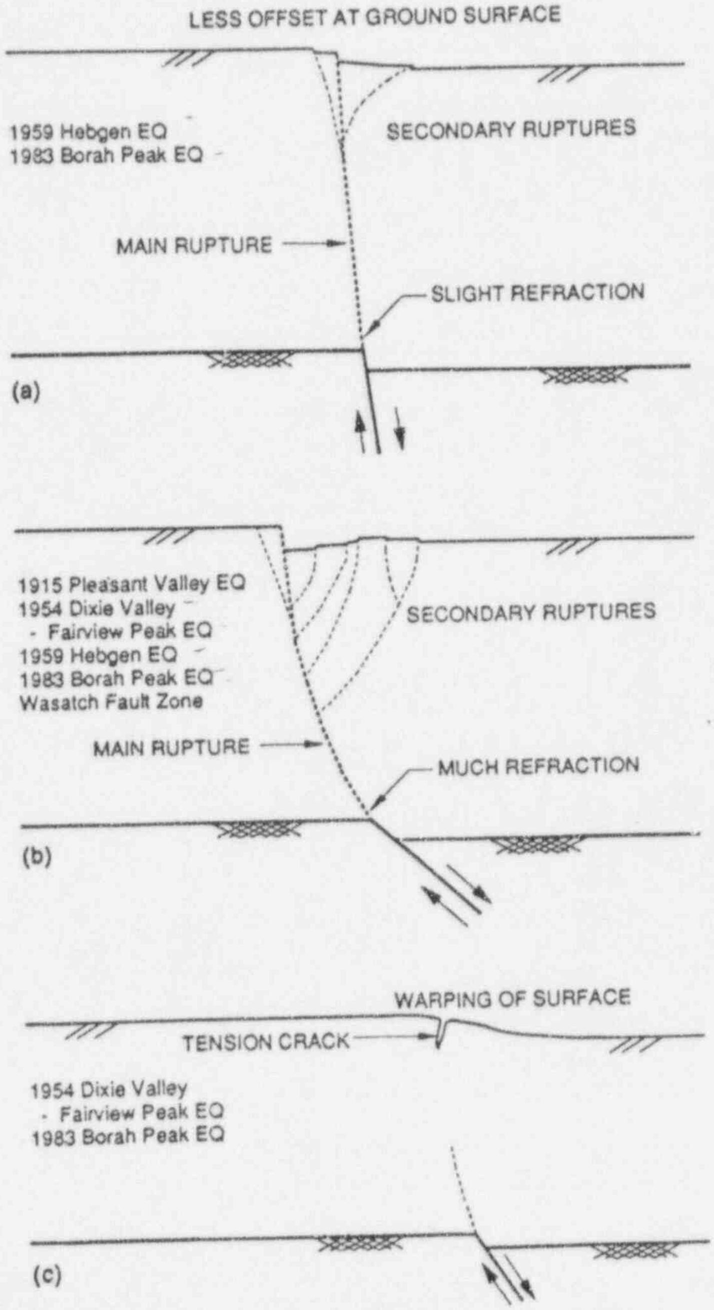


FIG. 7. **Path of Normal Fault Rupture through Soil: (*a*) Stiff Earth Materials, Steep Dip; (*b*) Stiff Earth Materials, Shallow Dip; (*c*) Ductile Earth Materials**