Department of Energy
Albuquerque Operations Office
P. O. Box 5400
Albuquerque, New Mexico 87115

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Gnugnoli
(Return to WM, 623-SS)

Mr. Giorgio Gnugnoli
United States Nuclear Regulatory
Commission
Mail Stop 623-SS
Washington, DC 20555

Dear Mr. Gnugnoli:

Enclosed for your information and review are the responses to NRC comments on the Lakeview draft RAP. We will be available to discuss the responses more fully, as well as provide you a short design presentation, in September 1985.

Sincerely,

Mark L. Matthews

Mark L. Matthews, Project Engineer
Uranium Mill Tailings Project Office

Enclosure

JE JACOBS ENGINEERING GROUP INC.
ADVANCED SYSTEMS DIVISION, ALBUQUERQUE OPERATIONS

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August 14, 1985

Mr. John G. Themelis
UMTRA Project Manager
U. S. Department of Energy
Uranium Mill Tailings Project Office
5301 Central Avenue, N.E., Suite 1700
Albuquerque, New Mexico 87108

Attention: Mark Matthews

Re: Response to NRC Comments on the Lakeview Draft RAP, EA (D) PSCR, (D) DSCR
Contract No. DE-AC04-82AL14086

Dear John:

The NRC submitted comments on the Lakeview Draft RAP and other reports in a letter dated June 19, 1985. Attached are the TAC responses to the NRC comments. Items of concern have been discussed with the NRC prior to formalization of responses. If you have any questions concerning the response to comments, please contact Leon Stepp of our staff or myself.

Very truly yours,
JACOBS ENGINEERING GROUP, INC.

Roger L. Williams
Project Manager

RW/LP/LS/tb

Attachment

RESPONSE TO

NRC COMMENTS DATED JUNE 19, 1985

ON

LAKEVIEW ENVIRONMENTAL ASSESSMENT

LAKEVIEW (D) REMEDIAL ACTION

LAKEVIEW (D) PSCR, AND

LAKEVIEW (D) DSCR (COLLINS RANCH SITE)

GROUND-WATER COMMENTS: DRAP

1. Comment

P. 21, Paragraph 3: Design Concept; and P. 35, Paragraph 2: "Ground-Water Protection." Please provide the technical basis by which a one-foot-thick radon barrier and a two-foot-thick compacted soil liner are considered to be sufficient to protect the ground water from contamination due to contaminant leaching through the stabilized pile.

Response

The key to ground-water protection is to limit net infiltration from the atmosphere through the cover and contaminated materials. The cover is the primary deterrent to leachate generation and transport. Once moisture redistribution occurs and a dynamic equilibrium exists, water passing through the cover and contaminated materials will continue to move downward or seep laterally. Therefore, a liner does not act to limit the net rate of fluid migration, although it may attenuate the movement of some chemicals and may cause uniform seepage. The information obtained through the data collection and analyses should be used to:

- Determine if the present cover is adequate for ground-water protection.
- If the cover is not adequate then determine an adequate cover design.

The technical basis will be stated in the RAP along with any final thickness changes. The data backup for all technical decisions will be added to the PSCR and DSCR as appropriate.

2. Comment

The DRAP calls for a two-foot thick liner in the disposal facility. However, both the draft DSCR and DEA do not indicate that a liner will be used. This discrepancy should be clarified.

Response

The need for a liner in the disposal facility is being evaluated. The final evaluation/determination will be reflected in the RAP.

3. Comment

Page 21 of the DEA states that below-grade excavation of the disposal area will extend to approximately 25 feet below the surface. Page 35 of the DRAP states that depth to water at the Collins Ranch site ranges from 20 feet to 76 feet below the proposed base of the tailings (ground water could therefore be as close as 20 feet beneath base of tailings). Page 15 of the draft DSCR states that ground water at the Collins Ranch site ranges from

35 feet to 127 feet beneath the surface (ground water could therefore be as close as 10 feet beneath the base of the tailings). This discrepancy should be clarified.

Response

The DEA reflects data and information available at the time of its preparation in February, 1985.

The DRAP and DSCR, published more recently, considered additional data. The final RAP and DSCR will reflect total data collected and will be consistent one with the other.

GROUND-WATER COMMENTS: DEA

1. Comment

Page 66, paragraph 1, Page 69, paragraph 3. The Lakeview site pump test summary together with the slug test results from both the Lakeview site and Collins Ranch site were reviewed (see pages 132, 133, and 134 of the draft PSCR and page 28 of the draft DSCR). The hydraulic conductivity values and calculated velocities are inappropriate because they were derived from invalid analysis methods. None of the pump test analysis methods presented in Table 5.4 of the draft PSCR are valid because many of the assumptions inherent to these methods are violated. From the very limited geologic data presented in the review documents, it would appear that the aquifers underlying the Lakeview and Collins Ranch sites are unconfined. It is therefore recommended that the pump test data be re-evaluated, taking into account the apparent unconfined conditions and partially penetrating wells.

2. Comment

Following from No. 1 above, the Bouwer and Rice method presents the most representative values for K and T when analyzing the slug test data from the Lakeview and Collins Ranch sites. Assumptions inherent to the Skibitzke and Hvorslev methods invalidate their use at these sites. The geologic data presented in the review documents do not support the premise of confined or confined/leaky aquifer systems underlying these two sites.

Response to Comments 1 and 2 Above

Semi-confined conditions may be caused by the presence of predominantly clay lenses rather than by a single well-defined stratum (Jacob, 1946). Therefore, the Theis, Jacob-Cooper, Hantush-Cooper, and Hantush Modified Methods may be appropriate to assess the time-drawdown data for the deeper test at the Lakeview processing site. For pump tests in highly variable deposits, the observed responses in the observation wells, completed in the same interval as the pump well, should govern the methods used. For instance, if the data plot closely fit to a given type curve and the hydrogeologic conditions reasonably support the method of analysis, then the

results should be considered as reasonably representative. If the log-log plot of the time-drawdown data fit the Theis type curve and the calculated storativty is on the order of 10^{-3} to 10^{-5}, then the interval should be considered to be confined or semi-confined. For all pump test analysis methods, some assumptions will not be satisfied in any field situation.

The calculations and results represented in the LKV EA and RAP were checked and some were found to be in error. Tables 1 and 2 contain the corrected values of hydraulic conductivity using the Skibitske, Bouwer-Rice, and Hvorslev Methods. For each case, the Bouwer-Rice Method was used assuming an impermeable barrier at the base of the well and again assuming an impermeable boundary at a depth of 2000 feet. In some cases using the Bouwer-Rice Method, two straight lines were fit to portions of the data set. These values are shown with slashes between them. The Bouwer-Rice is considered to give the most representative values.

3. Comment

It is apparent from Tables 5.10, 5.11, 5.12, 5.13, and 5.15 (pp. 137-155) of the draft PSCR, that only one sample from each well was used to characterize the ground-water quality. It is recommended that additional samples be analyzed to better delineate temporal and spatial variability and to assist in determining the effects of geothermal activity versus contamination from the pile.

Response

A total of four sample sets (quarterly) will be used to adequately delineate temporal and spatial variability. The fourth set will be collected in October, 1985. The effects of geothermal activity versus contamination for the site have been identified with the use of stable isotope analyses of key water samples. These analyses indicate that downgradient sulfate and other dissolved solids are due primarily to the geothermal system rather than the site. The results of the quarterly sampling and stable isotope analyses will be included in the final PSCR and the final RAP.

4. Comment

Although a very limited amount of ground-water data is presented in the draft DSCR, no ground-water quality evaluation for the Collins Ranch site is presented in the DEA. As provided in Comment No. 4 above, additional ground-water quality data should be collected and evaluated to delineate the character of the alluvial aquifer underlying the Collins Ranch site. The evaluation should take into consideration temporal and spatial variability of the ground water.

Response

Quarterly ground-water samples will be collected at Collins Ranch to adequately delineate temporal and spatial variability. These data and analyses will be reported in the DSCR and the RAP.

Table 1 Slug Test Data
LKV01 (Lakeview Processing Site)

Well ID	Date	Skibitzke (ft/day)	Bouwer-Rice[a] (ft/day)	Bouwer/Rice[b] (ft/day)	Hvorslev (ft/day)
LKV01-501	8/26/84	*	2.3	1.6	2.4
LKV01-502	8/24/84	0.063	0.070	0.046	0.099
LKV01-503	9/5/84	1.023	0.702/0.362**	0.499/0.257**	0.595
LKV01-511	9/8/84	3.91	--	--	1.72
LKV01-512	9/9/84	*	2.63	1.70	*
LKV01-513	9/11/84	1.02	0.63/0.087	0.45/0.063	0.48
LKV01-514	9/12/84	0.042	0.28/0.019	0.18/0.012	0.28
LKV01-517	9/13/84	*	1.54	1.01	*
LKV01-518	10/5/84	*	2.70	1.88	*
LKV01-521	9/8/84	0.56	1.04/0.21	0.76/0.16	*
LKV01-522	9/9/84	1.72	1.86	1.24	*
LKV01-523	8/29/84	*	1.17	0.81	*
LKV01-524	8/29/84	0.61	0.33	0.21	0.25
LKV01-525	9/7/84	*	5.38	3.71	*
LKV01-526	9/8/84	0.23	0.42	0.27	0.32
LKV01-516	9/10/84	*	2.50	1.62	*
Number of values		9	19	19	8
Arithmetic mean		1.02	1.28	0.867	0.768
Arithmetic standard deviation		1.21	1.36	0.930	0.831
Log mean		0.484	0.621	0.422	0.476
Standard deviation		4.45	4.33	4.36	2.84

[a] Assuming impermeable boundary at bottom of well.
[b] Assuming impermeable boundary at 2000 feet depth.
* Invalid
** 2 lines fitted.

Table 2 Slug Test Data
LKV01 (Lakeview Disposal Site B)

Well ID	Date	Skibitzke (ft/day)	Bouwer-Rice[a] (ft/day)	Bouwer/Rice[b] (ft/day)	Hvorslev (ft/day)
LKV02-508	10/05/84	2.75	0.79	0.55	*
LKV02-513	10/05/84	1.38	0.47	0.34	0.67
LKV02-514	10/05/84	0.64	0.31/0.15	0.23/0.11	0.33
LKV02-515	10/05/84	*	1.33	0.96	1.41
LKV02-516	10/03/84	0.049	0.055	0.039	0.106
Number of values		4	6	6	4
Arithmetic mean		1.20	0.518	0.372	0.629
Arithmetic standard deviation		1.17	0.475	0.340	0.570
Geometric mean		0.587	0.329	0.237	0.426
Geometric standard deviation		5.81	3.17	3.17	3.01

[a] Assuming impermeable boundary at bottom of well.
[b] Assuming impermeable boundary at 2000 feet depth.
* Invalid.
** Two lines fitted.

Table 3 Summary of LKV Pump Test Analyses

Pump well	Observation well	Analysis method	T (ft^2/day)	S	K (ft/day)
519	503	Jacob-Cooper	64.3	1.1×10^{-4}	--
519	503	Hantush-Jacob	28.8	8.9×10^{-5}	0.015
519	511	Jacob-Cooper	6.4	1.6×10^{-4}	--
519	511	Hantush-Modified	3.7	2.3×10^{-4}	7.1×10^{-3}
519	521	Jacob-Cooper	57.4	1.6×10^{-3}	--
519	521	Hantush-Jacob	41.4	2.0×10^{-3}	4.9×10^{-2}
Arithmetic mean		--	33.7	6.98×10^{-4}	0.0237
Arithmetic standard deviation		--	25.4	8.64×10^{-4}	0.0223
Log mean		--	21.7	3.24×10^{-4}	0.0173
Log standard deviation		--	3.33	3.92	2.65
520	504	Jacob-Cooper	96.6	2.5×10^{-4}	--
520	504	Hantush-Modified	13.6	4.1×10^{-6}	8.4
520	512	Jacob-Cooper	95.1	6.6×10^{-4}	--
520	512	Hantush-Jacob	90.6	8.5×10^{-4}	4.3×10^{-2}
520	512	Hantush-Modified	70.4	6.6×10^{-4}	5.4×10^{-1}
520	522	Jacob-Cooper	254	2.8×10^{-2}	--
Arithmetic mean		--	103.4	5.07×10^{-3}	2.99
Arithmetic standard deviation		--	80.1	0.011	4.69
Log mean		--	76.6	4.69×10^{-4}	0.580
Log standard deviation		--	2.60	17.02	14.0

GEOLOGY/SEISMOLOGY COMMENTS

DEA/DRAP

1. Comment

In order to adequately assess the Collins Ranch site against the EPA longevity requirements, additional information regarding the regional and site specific geology, seismology, and geothermal activity, similar to that provided for the Lakeview site, are required. Specifically, the DEA/DRAP should provide a discussion of the regional and site specific geology, seismology, and geothermal activity which includes the following:

- The relationship between the regional tectonics and the site specific structural geology.
- The relationship between the regional seismology and the MCE determined.
- The relationship between the regional geothermal activity and the potential geothermal activity.
- An assessment of the potential for liquefaction at the Lakeview and Collins Ranch sites.

The information required usually can be derived from a review of existing, pertinent geologic literature. The information should be documented by references to all relevant published and unpublished material. The UMTRA Project document review process will be expedited if the DOE submittals contain sufficient information for the reviewer to make an independent assessment of the conclusions regarding the geologic suitability of the Lakeview site and the proposed alternative site.

Response

Regional and site specific geologic, seismologic, and geomorphic studies are discussed in the draft Disposal Site Characterization Report for the Alternate Uranium Mill Tailings Disposal Site at Collins Ranch near Lakeview, Oregon, along with the Processing Site Characterization Report for the Uranium Mill Tailings Site at Lakeview, Oregon; both published and distributed in March, 1985.

GEOTECHNICAL/COVER DESIGN COMMENTS: DRAP

1. Comment

Page B-17. The method used for correlating blow count data with shear strength values should be specified. Friction angles of 38 degrees and 41.5 degrees for SM-ML materials appear somewhat high, based on typical values for a silty sand as shown on Table 17.1 of Terzaghi and Peck.

Response

Blow counts were correlated to strength using Figure 19.5 from Peck Hansen and Thornburn (copy attached). The average blow count in the upper foundation soils was 36 and that of the lower foundation soils was 53. Laboratory tests were run on silt (MH) soils from these zones with resulting PHI angles of 38 degrees and 41.5 degrees. Subsequent laboratory testing resulted in effective PHI angles of 39.5 degrees for a silty sand with gravel and 36.7 degrees for a similar material obtained from the deeper layer. Based on the triaxial test data, it is considered that the strength parameters selected are realistic for the materials encountered, and that an effective PHI angle of 38 degrees is conservative and appropriate for both layers.

Examination of the stability analyses indicates that minimum factors of safety were reached in circles that passed through the upper foundation soil (PHI = 38°) but did not touch the deeper soil. The exception was the short-term slope stability which did have a slip circle touch this "hard bottom." However, the resulting factor of safety was 4.5. This review indicates that changing the PHI angle of this lower layer from 41.5 degrees to 38 degrees would have no effect upon the factors of safety obtained. Results of these laboratory tests are attached.

2. Comment

Page B-42. The cover thickness calculation assumes a residual moisture content of 16.0 percent. However, NRC staff calculations using Equation 16 of NUREG/CR-3533 (Rogers, 1984) and grain size distribution data from Figures 9.2 through 9.11 of the Collins Ranch DSCR, resulted in a residual moisture content of 11.9 percent. Further, the average long-term moisture content calculated by DOE using the Rogers equation, also was 11.9 percent. Finally, the average in-situ moisture content for three near-surface (2.5 feet) soil samples from Table 9.1 of the Collins Ranch DSCR is 12.5 percent. The rationale for the moisture content assumed in the cover thickness calculations should be better documented to allow independent conclusions regarding the validity of the figure.

Response

Comparison of the gradation curves for this site indicates two distinct material types, a sandy silt and a silty sand. Comparison of the test pit and boring logs indicates that the near surface soils are predominantly silts, sandy silts, and a few clays. The silty sand soils are more limited under the site. The silty sand soils will not be used to construct the radon barrier or low-permeability layer, but will be removed and used for general restoration fill.

Capillary-moisture relationship tests run on representative borrow samples and reported in the Draft Disposal Site Characterization Report for the Alternative Uranium Mill Tailings Disposal Site at Collins Ranch near Lakeview, Oregon (March, 1985) show that the -2 bar moisture content ranges from 15 percent to 24 percent with an average of 20.9 percent. The -15 bar

moisture content ranged from 11 percent to 20.2 percent with an average of 16.9 percent. The optimum moisture content for these same soils ranged from 26.8 percent to 52 percent with an average of 42 percent.

Based on the facts that the radon barrier soils will be placed at a moisture content above optimum, and that most in-situ moisture contents are above 20 percent with many above 40 percent, and also recognizing the large difference between the compacted moisture content and the -2 bar moisture content, a conservative long-term moisture content of 16 percent was chosen. Due to the limited data associated with the study and the wide band of uncertainty associated with the curve fit of data, the application and validity of Equation 16 of NUREG/CR-3533 (Rogers, 1984) is considered questionable.

3. Comment

Page B-49. Table 6.5 of NUREG/CR-2642 indicates that a petrographic examination of rock provides valuable information regarding the overall quality of the rock. Therefore, the evaluation of riprap quality should include a petrographic examination. In addition, several of the tests specified utilize acceptance criteria which are not appropriate. As specified in Table 6.2 of NUREG/CR-2642, the weight loss after 250 freeze-thaw cycles should not exceed five percent, while values from the Schmidt impact hammer test should exceed 40. Additionally, provide the basis for the 20 percent increase in rock size to account for durability or lack thereof.

Response

Because of the nature of the formation of the rock source (basalt flow), petrographic examination of the rock was not regarded as the most appropriate indicator of the durability of the rock for this particular site. Better indications of the durability for the rock source are the following:

- Absorption Test.
- Sulfate Soundness Test.
- Specific Gravity.
- Los Angeles Abrasion Test.
- Schmidt Hammer.

Due to the high cost of the freeze-thaw test, it is not recommended that this test be run unless the rock is of fair to poor quality as judged by the results of other tests. Also, the 250 cycles are excessive and is probably a misprint and should be 25 as suggested by AASHTO. To run 250 cycles would take 80 to 90 days which is an unacceptable amount of time.

For the Schmidt Hammer test, it is agreed that a reading greater than 40 should be used in the field as a quick indicator of durability. However, since the rock source is a basalt flow with variable durability, increasing the rock size by 20 percent and reducing the specification could be more realistic and would still provide a durable rock source.

4. Comment

Page B-45. The rock layers on the top and sideslopes should be designed to prevent erosion due to the inevitable concentration of sheet flow which will result from a PMP event. A concentration of flow has not been considered in the design.

Response

The foundation, tailings, and cover materials will all be compacted in place during construction. In addition, the tailings will be "blended" into a homogeneous soil as a result of the excavation, transportation, unloading, spreading, and compacting that will occur. Because of this "blending," the settlement across the pile will be uniform. Some differential settlement will occur due to differential loading; however, this has been calculated to be approximately 0.05 percent (0.22 feet in 450 feet). This settlement is considered negligible and within the tolerances of placement. Based on the above conditions, the need to take into account the effect of potential flow concentration is considered unnecessary in the conceptual design.

SURFACE HYDROLOGY AND EROSION COMMENTS: DRAP AND DEA

1. Comment

Based on a review of the conceptual design presented in the RAP, there is a major deficiency in the design of the diversion ditch (East Ditch) that will be constructed upstream of the remediated pile. A qualitative examination of the design indicates that the ditch can become clogged with sediment and debris on a routine basis and will thus need frequent and regular maintenance. Based on the need for such maintenance, the EPA long-term stability criteria (40 CFR Part 192) will not be met by such a design. Because the location of the sediment buildup cannot be predicted and because the sediment buildup could be concentrated, we conclude that flows could be blocked at critical areas in the ditch, resulting in flows over the remediated embankment. However, EPA standards could be met by one of the following methods:

- o Move the remediated pile upstream, where little or no drainage area has to be intercepted by a diversion ditch.
- o Design the rock protection on the remediated pile to resist the runoff from the additional contributing upstream drainage area.
- o Design the topslope of the pile such that runoff is directed toward, rather than away from, the diversion ditch.

Alternately, if none of the above methods are used to resolve the problem, additional information and analyses should be provided to document that blockage and sediment accumulation in the ditch will not be a potential problem.

Response

Calculations have verified that blockage and sediment accumulation in the ditch will not be a potential problem.

The east ditch was analyzed at four points. Velocities for the 50-, 100-, 500-year and PMP events were compared with sediment transport curves provided in EM-1110-2-1601. The Modified Universal Soil Loss Equation was utilized in order to estimate the amount of sediment expected to settle in the ditch. These analyses show that the ditches would be scoured by storm events with recurrence intervals of 50 years or greater. Supporting calculations are attached.

2. Comment

Based on an examination of the site and of the information provided in the geomorphic analyses, it appears that significant gullying occurs in the immediate site area. Because of this, there exists a potential for concentration of runoff into the diversion ditches at one or more points (where such gullies would discharge flow to the ditch). It is therefore important to design the erosion protection in the ditch to resist the forces associated with concentrated flows which could enter the ditch perpendicular to the ditch alignment. It is also important that the design is capable of resisting the forces associated with significant energy dissipation directly in the ditch at a location where a potential gully could discharge into the ditch. Accordingly, the ditch design (all ditches) should be revised to account for the above phenomena. Provide the bases for all assumptions and calculations.

In addition, the geomorphic analyses indicate that head cutting of the existing gullies and channels in the site area could be a potential problem. Additional erosion protection should be provided to prevent the occurrence of head cutting and to provide transitions where the flows from the proposed diversion ditches discharge into existing gullies and channels. Accordingly, the diversion ditches and ditch transitions should be designed to protect the remediated pile from damage due to the erosion of existing channels and gullies. Detailed plans of the transitional ditches should be provided for review.

Response

Since the drainage area above the east ditch is relatively flat above points where flow enters the ditch perpendicular to the ditch alignment and since the 5:1 sideslopes would be lined with a one-foot-thick layer of erosion protection, it is not expected that gullies could damage the ditches and no additional analysis is deemed necessary.

Detailed plans of transitions and bends will be provided during final design.

3. Comment

Our review of the site plan indicates that the alignment of the east diversion ditch is not conducive to long-term stability. There are several locations where flows in the diversion ditch are directed toward the stabilized tailings. It appears that either (1) the ditch alignment should be revised such that flows are not directed toward the tailings at channel bends, or (2) additional erosion protection should be provided at those locations where curvature is necessary. Revise the design accordingly, and provide that basis for all assumptions and analyses (EM-1110-2-1601 provides acceptable guidance for determining increases in shear forces at channel bends).

Response

Preliminary analysis of two curves in the ditch was performed using equations provided in EM-1110-2-1601 (calculations are provided in the attached calculation set). This preliminary analysis indicated that no additional treatment is required at these bends. However, if additional analysis is required it should be performed during final design, prior to construction.

4. Comment

For the east diversion ditch, it appears that peak PMF flows may have been underestimated. This is principally due to the fact that critical combinations of drainage areas and times of concentration were not considered. Based on a qualitative examination of the site plan (as presented on Sheet 11 of 20 Calculation No. 346703050313-7B), it can be seen that due to the shape of the drainage basin, there are several locations along the ditch where the drainage area is only slightly less than the total area at the ditch outlet, but the time of concentration (which was computed based on watershed length) is about half the time of concentration at the ditch outlet. This effectively doubles the peak flow in the east ditch, for example, at a point located about 900 feet southeast of Mt. Augur.

Accordingly, the design calculations should be revised to reflect the most critical combinations of drainage area and time of concentration in all the diversion ditches. Several points along each ditch should be checked, due to the shape of the watersheds draining into the ditches. In addition, changes may need to be made in the riprap design in the ditches to reflect the increased flow rates, as applicable.

Response

The calculations have been revised to reflect the most critical combinations of drainage area, time of concentration, and route times (see calculations provided). The erosion protection has also been redesigned. The peak flow at the point located approximately 900 feet southeast of Mt. Augur, however, was not doubled but was less than the previous design flow. The size of the erosion protection was determined using the exit discharge, which was larger than the previous design flow, so that only one D_{50} need be specified for each ditch.

5. Comment

Our review of the rock protection for the sides of the tailings embankment indicates that the average rock size (D_{50}) needs to be increased. This is principally due to the fact that the rock voids will be filled with soil and that a majority of the runoff will pass over, rather than through, the rock layer. This results in an increase in the flow velocities which must be incorporated into the design.

For flow over a rock layer, the Stephenson method (used for designing the rock on the sides) is considered to be less applicable than the Safety Factors method (which was used for the top). We conclude that the Safety Factors method should be used in lieu of the Stephenson method, since very little flow will pass through the rock layer. The rock should be resized accordingly.

Response

Agreed. Revised text will contain increased D_{50} sizes that reflect all changes incorporated in determining the new values. These changes include the above, as well as the revised rainfall intensity distributions.

6. Comment

The methodology for determining rainfall distribution and intensities, as given in NRC Staff Technical Position Paper WM-8201, has been superseded by that given in the recently published Hydrometeorological Report (HMR) No. 55 (March, 1984). The NRC staff no longer endorses the methodology presented in WM-8201. WM-8201 was developed for use at active uranium mill sites, most of which are located in Wyoming, east of the Continental Divide. At the time of development of WM-8201, reasonable guidance for rainfall distributions in that area was unavailable and/or questionable. WM-8201 was formulated to provide that type of general guidance, based on Corps of Engineers rainfall distributions. The recent publication of HMR No. 55 has indicated that certain areas in Wyoming could be subject to rainfall intensities (especially of short duration) much greater than those given in WM-8210. As a result, the NRC staff intends to make appropriate modifications to WM-8201 to reflect the new data.

The modifications to WM-8201 will include recommendations to use the rainfall distribution guidance that is developed in the HMR that is appropriate for a given region. These modifications will be applicable to UMTRA Project sites in general. For the Lakeview site, in particular, the rainfall distributions developed from HMR No. 43 should be used, since this represents the most current estimate of rainfall potential for this area of the United States. Further, in developing rainfall distributions using HMR No. 43, extrapolation of the data for time intervals less than 15 minutes will be necessary.

Response

Rainfall distribution and intensities for this revised analysis were determined using distributions developed in HMR 43 and procedures similar to those presented in HMR 49. For durations less than 15 minutes, the one- to six-hour ratio data were input into a curve fit technique and the resultant equation was used to determine distribution values. The rainfall hydrographs and all pertinent calculations have been revised. Calculations are provided and the text will be revised accordingly.

RADON ATTENUATION AND RADIATION PROTECTION COMMENTS:

DEA V.I

1. Comment

Page 83. Based on a review of the background radiation for the Lakeview site, it was noted that the background Th-230 concentration was omitted. Thus, the background Th-230 concentration should be provided for the Lakeview site in order to complete the characterization of the site background radiological environment.

Response

Bendix Field Engineering Corporation (BFEC) conducted an extensive radiological site characterization survey at the Lakeview tailings site in 1984. Results of this study are contained in a report titled "Radiologic Characterization of the Lakeview, Oregon, Uranium Mill Tailings Remedial Action Site," published in June, 1984, and included as Appendix B to the Draft Processing Site Characterization Report for the Uranium Mill Tailings Site at Lakeview, Oregon (March, 1985). This report cites the number of soil samples analyzed for Th-230. Results indicate Th-230 levels representative of background. In addition, the Bendix report indicates samples were taken at five separate locations within a three-mile radius of the Lakeview tailings site for further background analysis. These samples will also be analyzed for Th-230. The results of these lab tests will be forwarded to the NRC when they are available.

2. Comment

Page 84. Based on a review of the Lakeview site gamma exposure rate, it was noted that information describing the distance from the pile that the gamma rate approaches background was omitted. Therefore, a gamma exposure rate isopleth for the Lakeview site should be provided.

Response

Figure 10 of the previously referenced radiological characterization report (Appendix B to the DSCR) indicates that gamma exposure rates greater than 18 microR/hr are primarily confined to the 258-acre Precision Pine site,

which includes the tailings pile, evaporation ponds, and mill yard areas. Gamma exposure rates are below 18 microR/hr at distances beyond approximately 1000 feet from each of these three areas.

3. Comment

Page 85. Based on review of the alternate site background radiation characterization, it was noted that air and soil site-specific radionuclide data were omitted. Thus, the background air and soil radionuclide concentration for U-Nat, Ra-226, and Th-230 should be provided for the Collins Ranch and Flynn Ranch sites.

Response

Four soil samples have been collected at the Collins Ranch and Flynn Ranch sites and are being analyzed for background levels of Ra-226, Th-230, and for natural uranium. Results of these analyses will be forwarded to the NRC when they are available.

4. Comment

Page 103. The footnote for Table 4.1 should reference Appendix H, not G.

Response

Agreed.

DEA V.II

1. Comment

(a)

Page H-7. The risk factor for excess fatal lung cancer, which in this DEA is 100×10^{-6} deaths per person-WLM, is used for the general population and for the remedial action workers. The Evans et al. (1981) reference, which gives the primary justification for using this risk factor, states that workers are at a higher risk than the general population for equal exposures to radon daughters. A higher risk factor comparable to those recommended by UNSCEAR and used by the NRC, should be applied to the remedial action workers.

Response

Since the preparation of the Lakeview EA, the risk factors for excess health effects have even reevaluated. A review of recent work on the effects of low level radiation shows that the United Nations Scientific Committee on the Effects of Atomic Radiation quoted a range of 200 to 450×10^{-6} deaths per person-WLM (UNSCEAR, 1977), while the EPA in its Final

Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites quoted 300 x 10^{-6} deaths per person-WLM (EPA, 1981). The BEIR-III report formulated an age-dependent model (NAS, 1980) for predicting the risk of lung cancer based on several studies of uranium and fluorspar miners. Evans et al. (1981) reviewed the BEIR-III study, lung cancer risk estimates published by other authors, and epidemiological evidence. They concluded that the most defensible upper-bound to the lifetime lung-cancer risk for the general population is 100 x 10^{-6} deaths per person-WLM. A compilation of these and other risk factor values is shown below:

Reference	Range (x 10^{-6} deaths per person-WLM)
UNSCEAR, 1977	200 to 450
NAS, 1980	200 to 1400
ICRP, 1981	150 to 450
Evans et al., 1981	100
EPA, 1982	300
NCRP, 1984a	100 to 200
USNRC, 1979	360

Using the approximate medium values and ranges reported above, a value of 300 x 10^{-6} health effects per person-WLM will be used for both remedial action workers and the general population. This results in a risk factor three times higher than those values presented in the EA, Appendix H, for bronchial epithelium doses due to radon daughter inhalation. The risk factor of 300 x 10^{-6} health effects per person-WLM is equivalent to a dose conversion factor of approximately 15 rem per WLM (NCRP, 1984b).

Comment

(b)

Comparing total organ doses over 50 and 100 years for both workers and the general population would help to clarify the difference when compared to expected background exposures rather than comparing only relative risk.

Response

The primary intent of an environmental assessment is to compare the relative impacts of each alternative to aid in the decision for a preferred alternative. An estimation of risk from typical background exposures to compare to estimated risks from each alternative will be considered for inclusion in the Remedial Action Plan.

2. Comment

Page H-14. The MILDOS computer program utilizes area sources and actual meteorological data. Use of MILDOS would provide a realistic dose prediction from which general population health effects estimates could be calculated in order to compare to the upper bound already calculated as the worst case.

Response

For an environmental assessment, which compares relative risks from each of the alternatives, it is believed that the methodology used for radiological risk assessment is adequate while minimizing time and cost factors relative to the effort required by MILDOS runs. The risk assessment methodology used attempts to be realistic but conservative.

The assumption referred to is one of the more conservative assumptions and it is agreed that it would result in an overprediction. However, comments from previous risk assessment documents in general, suggest that the methodology used is not conservative enough. Therefore, DOE feels justified in using the methodologies employed in the EA.

RADON ATTENUATION AND RADIATION PROTECTION COMMENTS:

DRAP

1. Comment

Page 8, Section 2.5, states that, when working levels are between 0.02 WL and 0.03 WL, the government will have the flexibility to decide if measures should be taken to reduce working levels. This is inconsistent with the EPA standard in 40 CFR 192.12(b)(1). The standard requires that a reasonable effort be made to reduce working levels to below 0.02 WL. A decision to take no action would constitute the application of supplemental standards.

Response

Agreed. The text will be revised to read as follows:

The standard requires that residual radioactive materials be removed from buildings exceeding 0.03 WL. In cases where levels are between 0.02 and 0.03 WL, the Federal Government will have the flexibility to use measures such as sealants, filtration devices, or ventilation devices to reduce concentrations to below 0.02 WL.

2. Comment

Page 19, Section 4.3. A statement should be added to indicate that more vicinity properties may be identified as remedial action proceeds.

Response

Agreed. The text will be changed accordingly.

3. Comment

Page 31, Section 5.5.4. Based on review of the cover construction program, it is unclear which radionuclide is referenced. Please clarify that this is a cleanup limit, and not an EPA limit for unrestricted use.

Response

The text will be changed accordingly.

4. Comment

Page 41. Based on review of the dust control program, it appears that dust control will depend exclusively on spraying. The DRAP should recognize the possibility of extreme dust conditions and require more restrictive controls when warranted. Therefore, a specific set of criteria should be established in order to allow reduction or stoppage of work. If such programs are described in a separate document, the DRAP should reference that document.

Response

The RAP will be revised to reference the RAC Construction Safety and Health Management Program which states as follows:

SECTION XIV - ENVIRONMENTAL CONTROL and MONITORING

A. Environmental control and monitoring are required to ensure that radioactive contamination, industrial toxics, or other hazardous materials do not disperse, by wind or water, into the general environment of the site.

   1. Boundary dust collection discs and continuous air monitors will be an integral part of the RAC environmental control program. The dust collection discs will be monitored on a daily basis to track radioactive dust dispersion. Continuous air monitors will give monthly, quarterly, and annual results to monitor off-site dispersion of particulates. The RAC Environmental Assessment Manager will determine when particulates will be analyzed for gross alpha, or when isotopic and elemental analyses are necessary.

   2. In the event that either of the above control monitors indicate an increase approaching unacceptable levels of radioactivity subcontractors may be required to take the following action: reduce vehicle speeds, water dusty construction areas, and/or stop work for extreme weather conditions. The site RSO in conjunction with the site manager will determine when these measures will be necessary.

   3. Water monitoring is also required to ensure no significant degradation of potable water supplies during remedial action. Construction activities may require modification in the event that a contamination problem is indicated.

B. Noncompliance with the above requests will be resolved through the RAC-Albuquerque Project Office.

Additional site specific controls will be developed and issued by the RAC prior to construction.

5. Comment

Page 51, Section 6.4.3. A signed statement by the employee, indicating that training was received, should be required. This statement should specify whether oral or written tests will be given. In addition, the supervisors should be given approximately four times the amount of training the workers receive; for example, 16 and four hours, respectively.

6. Comment

Page 56. As part of it's DRAP concurrence review, the NRC will need to review the "Radiological Support Plan" developed by DOE's contractor with the appendix applicable to Lakeview. Without this plan, we cannot evaluate the adequacy of the Environmental, Health, and Safety Plan contained in the RAP, Appendix D.

Response

The RAP will be revised to reference the RAC Health Physics Monitoring Plan which, in response to Comments 5 and 6, includes the following general information:

2.4 Health Physics Training Program

A formal radiological training program, including discussion of the biological effects associated with exposure to ionizing radiation, shall be provided to all site workers. The program will include discussion of radiological safety procedures, emergency procedures, and instructions concerning prenatal radiation exposure. Practical demonstrations of equipment usage will be incorporated, where appropriate. Literature concerning biological effects of radiation will be provided to workers, as will copies of USNRC Reg. Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure."

All site personnel will receive formal instruction in construction safety procedures, as per the program outlined in the RAC Safety and Health Management Program Plan.

Initial training sessions will be approximately two hours in length. Appropriate levels of training will be required of workers, based on anticipated exposure levels, and upon level of management responsibility as discussed previously. Each worker shall pass a written examination demonstrating comprehension of the training program contents. Permanent records of instruction and examination results will be maintained by the site RSO and the RAC, with copies forwarded to DOE upon completion of each training session.

Topics to be considered during the radiological training sessions will include:

- o SUMMARY OF UMTRAP OBJECTIVES
- o RADIATION TYPES
  - Beta
  - Gamma
  - Alpha
- o UNITS
  - Roentgen
  - Rad
  - Rem
  - Counts per minute, CPM
  - Disintegration per minute per 100 cm^2, DPM/100 cm^2
  - Curie, Ci
- o PROTECTION AGAINST RADIATION
  - Time (including calculation of dose and stay time)
  - Distance
  - Shielding
- o PROTECTION AGAINST CONTAMINATION
  - Protective clothing (including demonstration)
  - Smoking, eating, drinking in controlled areas
- o BIOLOGICAL EFFECTS
  - Effects of acute dose
  - Effects of chronic dose
- o RADIATION ZONES
  - Radiation symbol and colors
  - Controlled area
  - Radiation area
  - Airborne radioactive area
  - Posting, physical, and administrative areas
- o PERSONNEL MONITORING FOR RADIATION
  - Film or TLD badges
  - Self-reading dosimeters
  - Exposure records
  - Other types of personnel monitoring instrumentation
- o DOSE LIMITS (DOE ORDER 5480.1A)
  - Whole body dose
  - Skin dose

- Extremity dose
- Airborne activity
- Emergency dose
- NRC form, NRC-4

o PERSONNEL MONITORING FOR CONTAMINATION

- Survey when leaving contaminated area
- Whole body counting
- Bioassay

o RADIATION RECORDS

- Exposure records
- Bioassay records
- Accuracy of information
- Records retention

An appendix to the RAC Health Physics Monitoring Plan entitled Lakeview Health Physics Plan will also be issued prior to start of construction. That appendix will address training and other programs tailored to site specific conditions.

7. Comment

Page D-19. Due to the long biological half-lives for both Th-230 and Ra-226, NRC considers these bioassays to not provide representative indications of employee internal exposure. Therefore, U-Nat urinalysis should be used since it would be more sensitive and provide a more reliable indication of employee internal exposure.

Response

In evaluating analytical parameters for bioassay programs, U-nat was considered to exist in tailings in such reduced concentrations, due to the milling process, that other radionuclides may serve better as indicators of internal exposure. Typically U-nat is more soluble than Th-230 or Ra-226 in tailings, and would be more readily excreted in the urine. However, only five to 15 percent of the uranium originally in the ore remains in the tailings, and a wide range of solubilities exists for the radionuclides in the tailings due to the various milling processes employed at the 24 UMTRA Project sites. Therefore, Th-230 and Ra-226 were selected as more sensitive parameters for Lakeview. The RAC is currently considering site- by-site solubility determinations, and other methods of measurement to ensure the adequacy and validity of their bioassay programs. The RAP will reference the RAC Health Physics Monitoring Plan with Lakeview Site Appendix for more specifics on the Lakeview site program.

8. Comment

Page D-21. Based on a review of the respiratory protection program, it was noted that no provisions for an in-house working level (WL) action lev-

el were provided. A WL in-house action level should be defined (e.g., 0.08 WL). Thus, when the action level is exceeded, an investigation to determine cause can be triggered, and proper mitigative actions can be taken.

Response

Administrative limits and action levels for radiological monitoring data such as radon progeny measurements will be established by the RAC in the site specific Health Physics Monitoring Plan. The RAP will reference the RAC Health Physics Monitoring Plan with Lakeview Site Appendix for specifics on the Lakeview site program.

within which the sand cannot slip with respect to the base of the footing because of the roughness of the base, moves downward as a unit. As it moves it displaces the adjacent material. Consequently, the sand in two symmetrical zones *aO'bde*, one of which is illustrated on the left side of Fig. 19.4, is subjected to severe shearing distortions and slides outward and upward along the boundaries *O'bd*. The movement is resisted by the shearing strength of the sand along *O'bd* and the weight of the sand in the sliding masses.

No completely adequate rigorous theory exists for calculating the ultimate capacity of a footing under such circumstances, but satisfactory approximate solutions have been obtained on the basis of various simplifying assumptions (Terzaghi, 1943; Meyerhof, 1955). It is assumed, as illustrated on the right half of Fig. 19.4, that the influence of the soil above the base level of the footing can be replaced by a uniform surcharge γD_f. Theory and experiment then indicate that the surface of sliding consists of a curved portion $O'c'$ and a straight section $c'b'$ that rises at an angle of $45° - \phi/2$ with the horizontal. The load q_d' on the footing, the surcharge γD_f, and the weight W of the sliding mass all produce normal stresses across the surface of sliding $O'c'b'$, which, in turn, develop frictional shearing resistance along the surface of sliding. When the mass is on the verge of sliding the resultant R of the normal and shearing stresses at any point such as f on the surface of sliding is inclined at the angle ϕ to the normal to the surface of sliding. The wedge $O'c'b'a'$ may be considered as a free body and its equilibrium investigated to evaluate q_d'. Various trials must be made to find the surface of sliding corresponding to the least value of q_d' that can be developed. This least value is designated the ***gross ultimate bearing capacity***.

The results of such studies indicate that the gross ultimate bearing capacity may be expressed as

$$q_d' = \tfrac{1}{2}B\gamma N_\gamma + \gamma D_f N_q \qquad 19.1$$

and the ***net ultimate bearing capacity*** as

$$q_d = q_d' - \gamma D_f$$
$$= \tfrac{1}{2}B\gamma N_\gamma + \gamma D_f(N_q - 1) \qquad 19.2$$

In these equations, N_γ and N_q are dimensionless *bearing-capacity factors* depending primarily on ϕ. They may be evaluated by means of the chart, Fig. 19.5.

Equation 19.2 demonstrates that the bearing capacity of a footing on sand is derived from two sources: the frictional resistance due to the weight of the sand below the level of the footing and the frictional resistance due to the weight of the surrounding surcharge or backfill.

The unit weights of most sands, whether dry, moist, or saturated, lie within a fairly narrow range. Therefore, the unit weight of the sand is in itself not an important variable in the determination of the bearing capacity of a footing. However, if the sand is located below the free water surface, only its submerged weight is effective in pro-

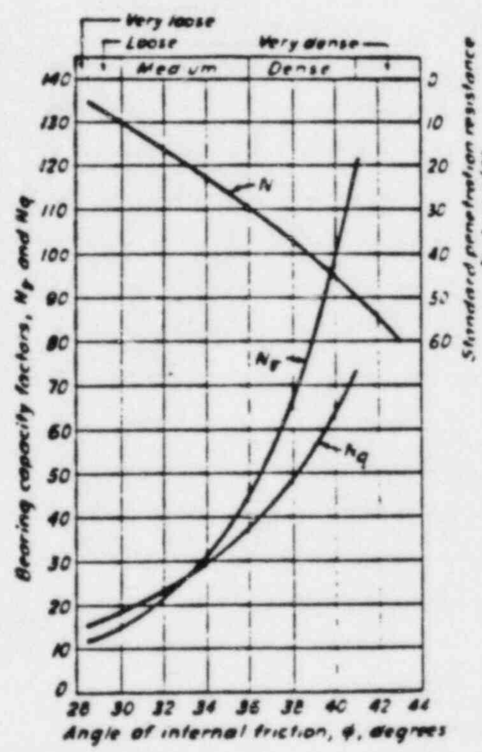
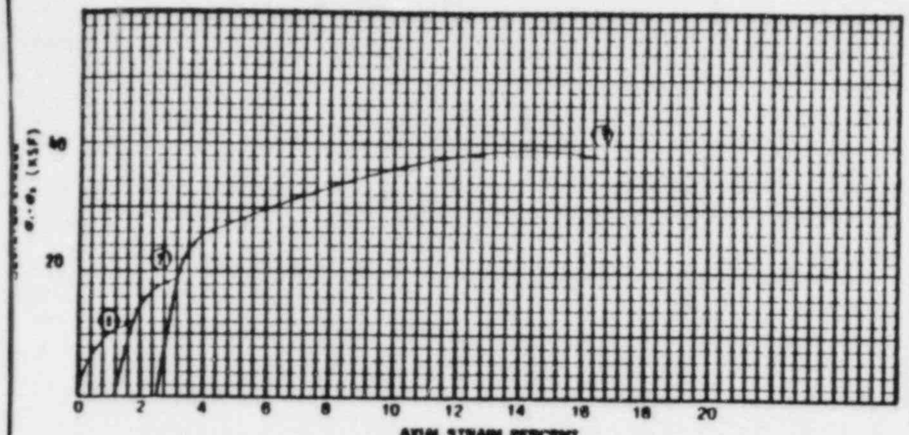
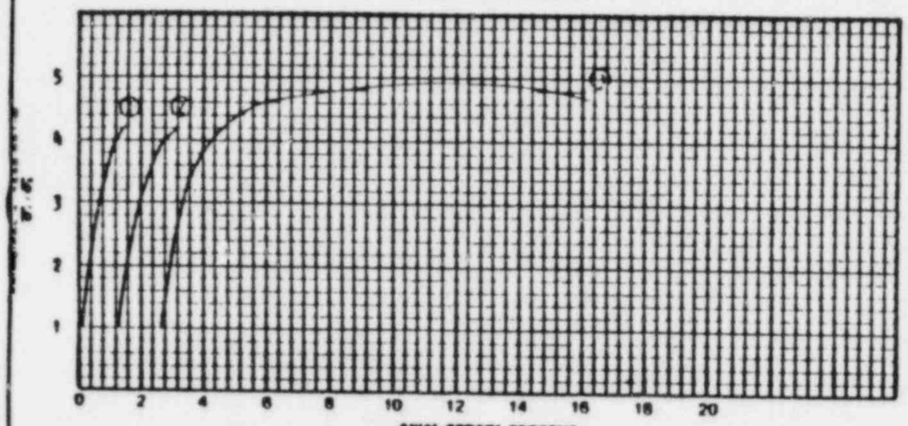
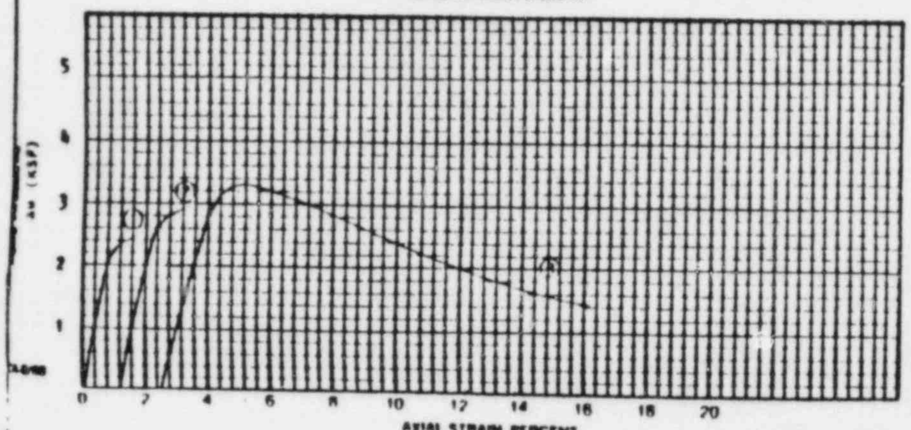


FIGURE 19.5. Curves showing the relationship between bearing-capacity factors and ϕ, as determined by theory, and rough empirical relationship between bearing capacity factors or ϕ and values of standard penetration resistance N.



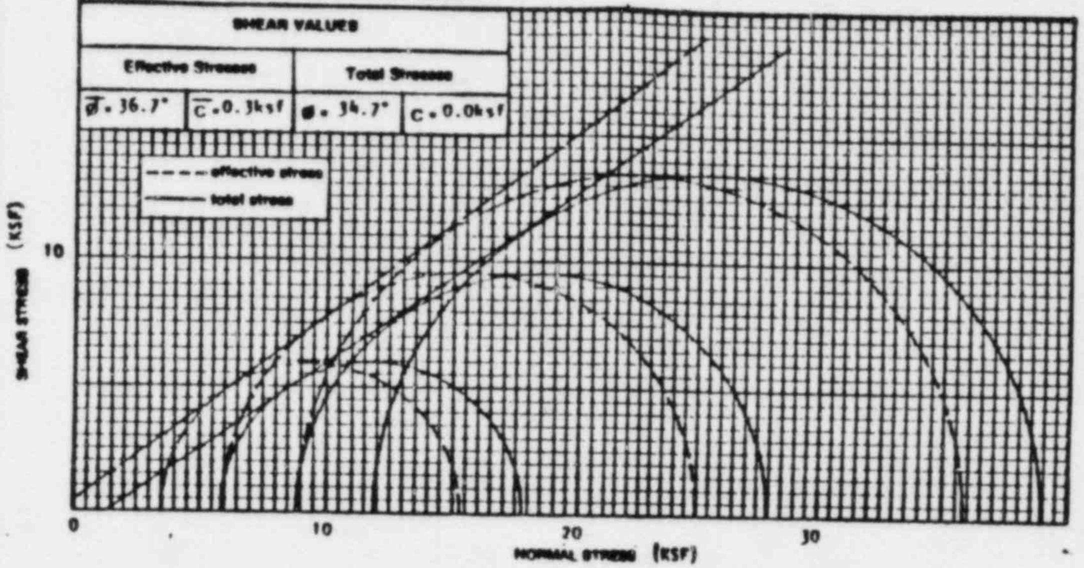




SHEAR STRENGTH OF SOIL IN TRIAXIAL COMPRESSION

Job No. JE 012
Date July 17, 1985
Type of Test Saturated, consolidated, undrained with pore pressure measurements

SHEAR VALUES			
Effective Stresses		Total Stresses	
$\bar{\phi}$ = 36.7°	$\bar{C}$ = 0.3ksf	ϕ = 34.7°	C = 0.0ksf

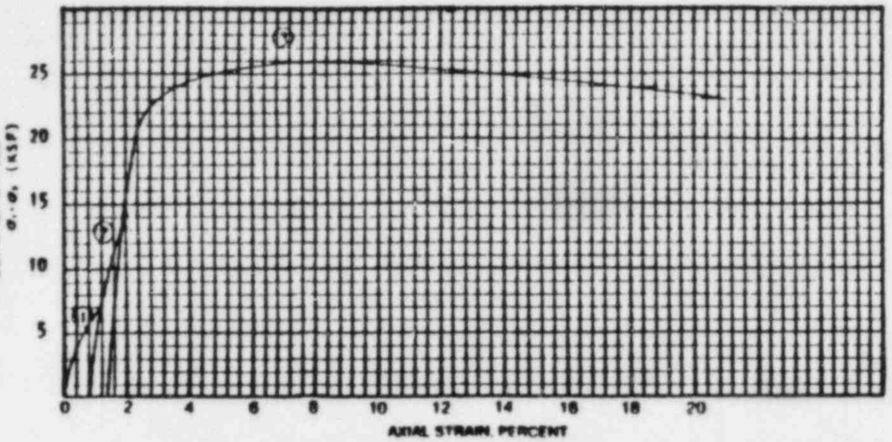


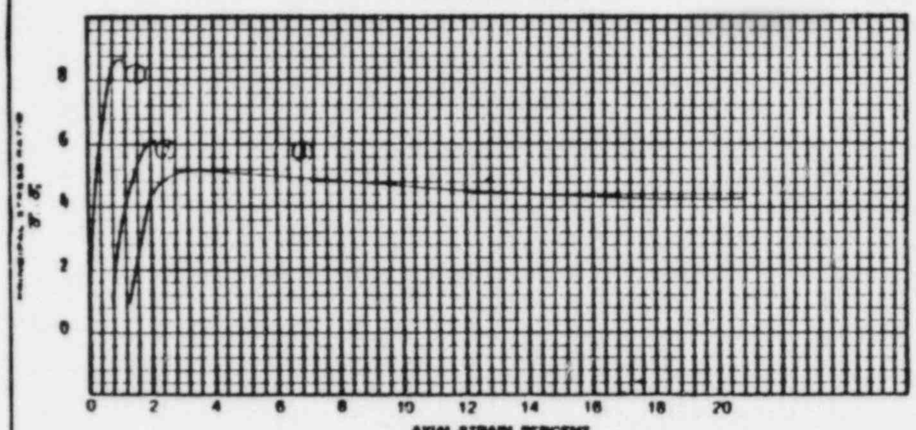
STAGE Number	Specimen Location: Boring Number	Specimen Location: Depth (Ft)	Initial Specimen Data: Sample Type	Initial Specimen Data: Length (in)	Initial Specimen Data: Diameter (in)	Initial Specimen Data: Dry Density (P.C.F.)	Initial Specimen Data: Moisture Content (%)	Soil Description
1	12A	59.25-60.75	2.5"Tube	4.899	2.365	101.1	17.6	Sand, gravelly, silt
2	12A	59.25-60.75	2.5"Tube	-	-	106.1	23.5	Sand, gravelly, silt
3	12A	59.25-60.75	2.5"Tube	-	-	107.3	22.9	Sand, gravelly, silt

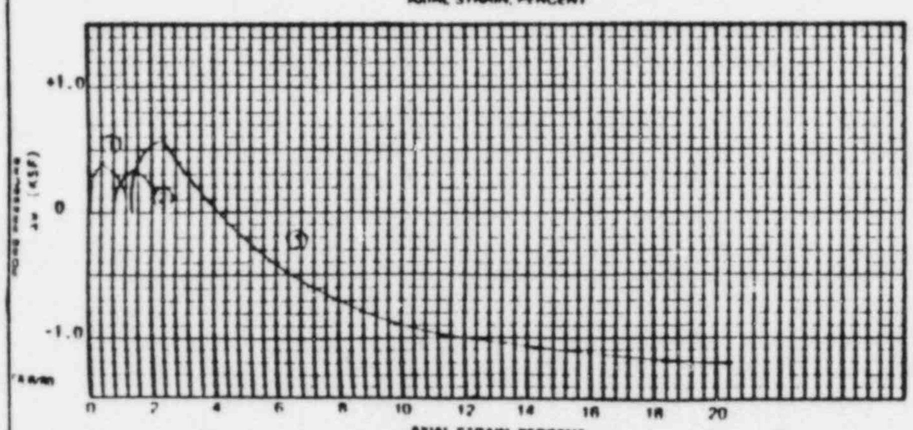
STAGE Number	$\bar{B}$ Parameter	Test Values at Failure as plotted: Total Confining Stress σ_3	Total Axial Stress σ_1	Deviator Stress $\sigma_1-\sigma_3$	Effective Lateral Stress $\bar{\sigma}_3$	Effective Axial Stress $\bar{\sigma}_1$	Pore Pressure μ	Percent Strain ε %	Remarks
1	.99	5.962	17.694	11.732	3.528	15.260	2.434	1.61	All units in KSF
2	-	8.899	27.819	18.920	5.976	24.896	2.923	1.80	All units in KSF
3	-	11.808	39.009	27.201	8.726	35.927	3.082	1.80	All units in KSF

Remarks: Specimen location depth on received tube was 57.5'-62.5'.

Fig ______







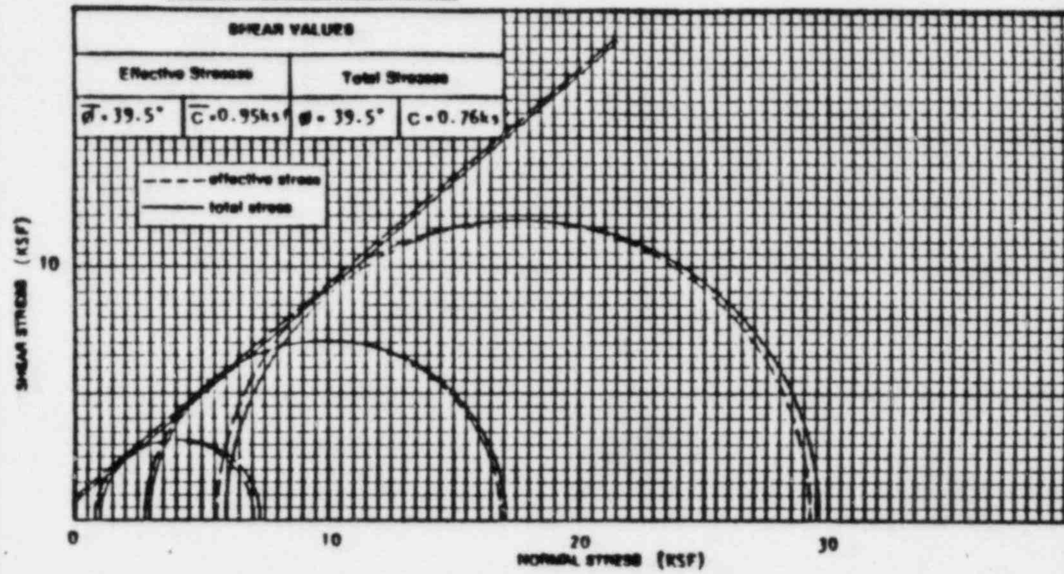
SHEAR STRENGTH OF SOIL IN TRIAXIAL COMPRESSION

Job No. JE 012

Date July 17, 1985

Type of Test Saturated, consolidated undrained with pore pressure measurements.

SHEAR VALUES			
Effective Stresses		Total Stresses	
$\bar{\phi}$ = 39.5°	$\bar{C}$ = 0.95ksf	ϕ = 39.5°	C = 0.76ks



STAGE Number	Specimen Location: Boring Number	Specimen Location: Depth (Ft)	Initial Specimen Data: Sample Type	Length (In)	Diameter (In)	Dry Density (PCF)	Moisture Content (%)	Soil Description
1	38	9.75-10.75	2.5"Tube	5.370	2.365	94.6	16.9	Sand, silty, gravelly
2	38	9.75-10.75	2.5"Tube	-	-	97.1	29.9	Sand, silty, gravelly
3	38	9.75-10.75	2.5"Tube	-	-	101.0	27.4	Sand, silty, gravelly

STAGE Number	B Parameter	Test Values at peak $\bar{\sigma}_1/\bar{\sigma}_3$: Total Confining Stress σ_3	Total Axial Stress σ_1	Deviator Stress σ_1-σ_3	Effective Lateral Stress $\bar{\sigma}_3$	Effective Axial Stress $\bar{\sigma}_1$	Pore Pressure μ	Δ Percent Strain ε%	Remarks
1	.96	1.022	7.309	6.287	0.806	7.093	0.216	0.99	All units in KSF
2	.98	2.909	17.129	14.220	2.765	16.985	0.144	1.28	All units in KSF
3	.98	5.962	29.616	23.654	5.659	29.313	0.302	1.90	All units in KSF

Remarks Specimen location depth on received tube was 7.5'-12.5'.

Fig ______